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Dr Horsfield &c &c &c
from C Holtzapffel

DESCRIPTIVE CATALOGUE

OF THE

WOODS COMMONLY EMPLOYED

IN THIS COUNTRY

FOR THE

MECHANICAL AND ORNAMENTAL ARTS.

INTERSPERSED WITH

Extensive Botanical Notes,

BY

DR. ROYLE, M.D., F.R.S., L.S., AND G.S., ETC. ETC.

OF THE EAST INDIA HOUSE;
PROFESSOR OF MATERIA MEDICA AND THERAPEUTICS, KING'S COLLEGE, LONDON.

PRECEDED BY SOME REMARKS ON THE GROWTH, DIFFERENCES, AND MODES OF USING AND COMBINING THE WOODS.

THE WHOLE BEING AN EXTRACT FROM A WORK ENTITLED

TURNING AND MECHANICAL MANIPULATION.

ETC., ETC.

BY

CHARLES HOLTZAPFFEL,

ASSOCIATE OF THE INSTITUTION OF CIVIL ENGINEERS, ETC.

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PREFACE

TO THE FIRST VOLUME.

THE author was led to undertake the present work on Turning and Mechanical Manipulation, from the circumstance of there being no general treatise in the English language for the guidance of the Amateur in these pursuits. The original works by Plumier and Bergeron, although they were suited to the periods at which they were produced, are neither of them sufficient to convey instruction adequate to the present state of the Art; and the more recent French works leave unnoticed a large portion of the machines and instruments now used by Amateurs.

The greatest difficulty the author has encountered in his task, has been that of selection and arrangement; so as to produce, from materials so numerous and dissimilar, a work of general reference and practical instruction, at once sufficiently copious and accessible. But he hopes this difficulty has been satisfactorily met, by the division of the work into five volumes, upon parts of the subject which are broadly distinguished, and which thereby render the volumes in a great measure independent of each other. This plan is also carried out in the subdivision of the volumes into chapters, which may be considered severally to include all that was deemed necessary to be stated upon the respective subjects; or to be, so far as they extend, distinct treatises; and which, in cases of doubt, he has not hesitated to submit to various practical friends for confirmation or extension.

These appeals have been answered with an alacrity which calls for his warmest thanks; and the author gladly avails himself of this opportunity of acknowledging these services, which have given a great additional value to his labours.

The work being of a technical nature, the author hopes to escape literary criticism, his main object having been to treat each subject in clear and concise language. As, however, notwithstanding his utmost care, he cannot expect to have been so fortunate as entirely to have escaped errors, ambiguities, or omissions, he requests of his readers the favor of the communication of any such defects, in order that those of most material import may be noticed in the Appendix to the second and ensuing volume, a great part of which is already completed.

CHARING CROSS,
January 1, 1843.

TURNING
AND
MECHANICAL MANIPULATION.

CONTENTS OF THE VOLUMES.

VOL. I.

MATERIALS, THEIR DIFFERENCES, CHOICE, AND PREPARATION; VARIOUS MODES OF WORKING THEM, GENERALLY WITHOUT CUTTING TOOLS.

Introduction.—Materials from the Vegetable, the Animal, and the Mineral Kingdoms.—Their uses in the Mechanical Arts depend on their structural differences, and physical characters. The modes of severally preparing, working, and joining the materials, with the practical description of a variety of Processes, which do not, generally, require the use of Tools with cutting edges.

VOL. II.

THE PRINCIPLES OF CONSTRUCTION, AND PURPOSES, OF CUTTING TOOLS; ABRASIVE AND MISCELLANEOUS PROCESSES.

The principles and descriptions of Cutting Tools generally—namely, Chisels and Planes, Turning Tools, Boring Tools, Screw-cutting Tools, Saws, Files, Shears, and Punches.

Grinding and Polishing, extremes of the same process, and applied both to the production of form, and the embellishment of surface. Varnishing and Miscellanea.

VOL. III.

THE PRINCIPLES AND PRACTICE OF HAND OR SIMPLE TURNING.

Descriptions of various Lathes;—applications of numerous Chucks, or apparatus for fixing works in the Lathe. Elementary instructions in turning the soft and hard woods, ivory and metals, and also in Screw-cutting, with numerous Practical Examples; some plain and simple, others difficult and complex, to show how much may be done with hand tools alone.

VOL. IV.

THE PRINCIPLES AND PRACTICE OF ORNAMENTAL OR COMPLEX TURNING.

Sliding Rest with fixed tools—Revolving Cutters, used in the Sliding Rest, with the Division Plate and Overhead Motion. Various kinds of Eccentric, Oval, Spherical, Right-line and other Chucks· Ibbetson's Geometric Chuck. The Rose Engine, and analogous contrivances, &c.

With numerous Practical Examples.

VOL. V.

THE PRINCIPLES AND PRACTICE OF AMATEUR ENGINEERING.

Lathes with sliding Rests for metal turning, Self-acting and Screw-cutting Lathes—Drilling Machines—Planing Engines—Key-groove, Slotting and Paring Machines—Wheel cutting and Shaping Engines, &c.

With numerous Practical Examples.

Vols. I. and II. alone, will constitute a smaller yet complete work, which may be extended by the addition of either one or the whole of the other volumes, as each will be complete in itself.

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TURNING

AND

MECHANICAL MANIPULATION.

VOL. I.

MATERIALS; THEIR DIFFERENCES, CHOICE, AND PREPARATION; VARIOUS MODES OF WORKING THEM, GENERALLY WITHOUT CUTTING TOOLS.

◆

CHAPTER I.

INTRODUCTION.

In offering these pages to the public, it may be expected that in conformity with the usual custom, I should state briefly the general nature and purpose of my subject, noticing the principal works which have already been written upon it, and lastly, the method and arrangement adopted in the execution of my task.

It may, therefore, be premised that the practice of the Art of Turning constitutes the basis of the work, whilst the various mechanical arts associated with it, or derived directly from it, will form collateral branches of comment and inquiry.

The importance of the lathe towards the promotion of the useful arts will be readily admitted, when it is considered how large a proportion of the indispensable objects we daily use, are either immediately produced by its agency, or in a greater or less degree are dependent upon this machine. Indeed it may be truly asserted, that nearly all solid objects, (particularly those of wood or metal,) in which the circle or any of its modifications can be discovered, are the offspring of the lathe, which produces, from solid materials of every description, an almost endless number and variety of forms, the origin of which can be traced to that most simple, symmetrical, and best defined of all the mathematical figures, the circle.

No perfect or definite form is so easily or so accurately described as that of the circle; thus the compasses by placing one point on a sheet of paper or other material, and sweeping the pencil or style around the same, trace a line which returns into itself, and form a figure equi-distant at every part from the point within, termed its center; or the proceeding may be reversed, by giving the paper a rotary motion beneath the pencil, which is kept stationary, whereby the same figure is produced.

The latter modification constitutes the principle of the lathe; the fixed center of the compasses being equivalent to the fixed axis upon which the solid material is made to revolve by some mechanical arrangement; the tracing pencil is supplanted by the cutting tool, which being held in a certain position towards the axis of rotation, cuts a circular groove in the revolving material; or if it be applied to its edge, reduces the object to a circular form.

This proceeding includes the three primary elements which constitute the ordinary practice of turning; namely, an immoveable axis; the revolution of the material upon that axis; and a fixed position of the cutting tool, in order that it may pare away all the parts of the body that oppose it. But the application of these elements must be modified and extended, if we desire to produce a compound form, such for instance as a vase; the first two elements, or the fixed axis and the revolution of the material, are retained, whilst the tool is moved by slow degrees along the outline or contour of the vase, both within and without, so as to remove all those parts of the material which are in excess, or project beyond the ideal line to be produced: and the continued, though temporary application of the tool, at each individual point of the vase or other object, renders every section taken at right angles to its axis, a circle. There are other less important modifications of the lathe, in which the position of the axis is changed and rendered moveable during the revolution of the work, as in oval and rose-engine turning, but these variations need only be adverted to here.

The art of turning must be admitted to be an auxiliary of great importance in the economy of mankind, as to it we are more or less immediately indebted, for nearly all the component parts of the machines and instruments, which are conducive in a thousand ways, to the support and clothing of the person, and the advancement of the mind.

How, for instance, could the engines which are now habitually and almost universally employed, in converting the numerous raw products of the earth to our most urgent, as well as to our most refined necessities and pleasures exist, in the absence of the tools indispensably required for the accurate production of the circular parts, that enter so largely and in so important a manner, into their respective structures?

How again could we without the lathe, possess another machine in which the circle abounds, namely the steam-engine? which like an obedient automaton endowed with power and endurance almost unlimited, is equally subservient, either in converting the raw materials into their manufactured products, or in transporting them, in either state, across the ocean, or over the surface of the earth, along with the individuals, through whose energies they have been collected, transformed, and distributed.

Nor amongst our obligations to the mechanical arts, is that the least which is afforded by them in the cause of science, the delicate apparatus for pursuing which, is due to the skill of the mechanist, whose instruments enable us to discover, and likewise to measure the planetary orbs, or to inspect in the cabinet the wonderful particles of the world we inhabit; and by means of which we find our earth to be teeming with creation, exquisite in symmetry, and beautifully adapted to the purposes of organic life; indeed, in whatever direction, and with whatever purpose the man of science may look, prospects of similar grandeur, and of equal wonder, still open in endless succession to repay the labour of research, an effort wherein the instruments, (due in great measure to the turner's skill,) are only secondary in importance to man's own mental faculties.

How largely also, do the circle and its many combinations enter into the elegancies and ornaments of life: more particularly in the useful and indispensable creations of taste and fancy obtained from the wheel of the manufacturer of pottery and porcelain; and more or less so in all the arts of design and embellishment, whether applied to the useful and agreeable purpose of ornamenting the costume of nations; assisting towards the prosecution of the art of engraving; or in that most important of engines the printing-machine, which disseminates in millions of channels, the thoughts and speculations of the human mind; throughout all of which, the turner's primary element, the circle, is equally pervading and indispensable.

The important and different results to which we have cursorily referred, are in most cases greatly, and in others exclusively indebted for their formation, to an instrument based upon the law of rotary motion, (one of the most simple though perfect yet discovered,) the turning lathe, to which and its numerous accessories and subordinates, we must attribute the extension of the arts, by which our comfort and well-being have been materially augmented: whilst their abstraction from our hands would deprive us of numerous sources of industrious employment, and the constructive and mechanical arts would, in all probability, eventually degenerate to the low condition in which they may be still observed, amongst the few primitive aboriginal races yet remaining at the present day.

Will it therefore be taking too high a ground to call the lathe,—that primary machine which has conferred all these benefits upon us,—an engine of civilization? and may it not also be further asserted, that the extension of its employment in the higher and more important branches of manufactures and arts, especially in Great Britain, coupled with the talent, perseverance and industry of those who have developed its powers, have aided in elevating our country to its eminence among nations, by administering to its productive means, and its knowledge, and consequently, to its wealth and dominions?

I will now advert to the works that have been published on the art of turning, the honour attached to priority in which, belongs to France, the first treatise written exclusively upon the subject, being a folio volume entitled, "*L'Art de Tourner en Perfection*," by "*le Père Charles Plumier*, (*Religieux Minime*,") and printed at Lyons in 1701. The author herein goes so far back as to refer the practice of the art to Tubal Cain, who is recorded in Sacred Writ to have been the first worker in metal; whilst others attribute to him the invention of wind instruments, the organ, and various machines. Plumier considered it impossible that the circular parts of such works could have been made otherwise than by the process of turning, which therefore he presumes to have been known to mankind at an extremely remote period; he also considers that the numerous circular works and objects recorded to have existed in Solomon's Temple, including the lamps and musical instruments used therein, could not have been produced otherwise than by the use of the lathe.

That account of the origin of the art which ascribes it to Dædalus, and which is quoted by Plumier and the various Encyclopedists, appears to be derived from Felibien, (who wrote in 1690,) as will be seen by this literal extract from his pages.

"*L' invention du Tour est tres ancienne; Diodore de Sicile dit que le premier qui le mit en usage estoit un neveu de Dedale nommé Talus. Pline veut que ce soit un Theodore de Samos; et il parle d'un Thericles qui se rendit celebre dans ces sortes d'ouvrages.*"

Liv. 7, *c.* 56.
Liv. 16, *c.* 40.

"*C'estoit avec cette machine qu'ils tournoient toutes sortes de vases, dont quelques-uns estoient enrichis de figures, et d'ornemens en demy-bosse. Les Auteurs Grecs et Latins en parlent souvent, et Ciceron appelle ceux qui les formoient au Tour,* Vascularii. *C'estoit un proverbe parmy les Anciens, de dire que les choses estoient faites au tour, pour en exprimer la justesse, et la délicatesse**."

Lenta quibus torno facilis superaddita vitis. Virg. Egl. 3.
Vascularios convocari jubet. Cic. Orat. in Ver.

In conclusion the writer adverts to the great extent to which the art of turning had been practised by various persons, (*gens libres*,) as a source of amusing occupation. Without pursuing these researches it may suffice to observe, that sufficient evidence exists that the art of turning has been successfully practised during a period of not less than two thousand years, although until a comparatively recent date, no description has been given of the methods pursued.

Plumier adverts to the following old authors on various subjects, in which, amongst other matters, some brief allusions to the art are made, and which in point of date stand as follows:

1582. Besson's work, "*Theatrum Instrumentorum et Machinarum,*" has three engravings of complex lathes for screw-cutting, and oblique turning, with very slight descriptions.

1624. De Caus, "*Les Raisons des Forces Mouvantes,*" contains one engraving, and a few lines explanatory of a mode of turning the oval and of screw-cutting.

1677-83. "*Moxon's Mechanick Exercises, or the Doctrine of*

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* Pages 376-7.

Handy-Works," published in London, in monthly parts. Vol. I. contains, "*Smithing, Joinery, Carpentry, Turning, Bricklayery, and Meckanick Dyalling,*" with a good description of the apparatus for turning. Vol. II., "*Handy-Works applied to the Art of Printing.*"

1690. Felibien, "*Des Principes de l'Architecture, de la Sculpture, de la Peinture, et des autres Arts qui en dépendent:*" Paris. This author has devoted twelve pages to his remarks on the lathe, with a few words relative to the modes of oval turning, and to rose-engine work.

In 1719, (that is, eighteen years after Plumier's book,) a quarto volume was published at Lyons, styled "*Recueil d'Ouvrages curieux, de Mathématique et de Mécanique; ou description du Cabinet de M. Grollier de Serviere, par son petit-fils.*" This work contains eighty plates, with etchings of his grandfather's designs for time-pieces, hydraulic machines, various bridges, military and other works, preceded by twelve plates of several of his highly ornamental works executed in the lathe.

And lastly, in 1724-7, Leupold published at Leipzic eight folio volumes, entitled "*Theatrum Machinarum,*" &c., which include a vast store of curious and useful matter, containing the germs and principles of many contrivances that are now commonly and abundantly used.

All these books are contained in the library of the British Museum, except that of Plumier*, who appears not to have seen a rare book of more remote date than any of the above, namely, "*Panoplia Omnium,*" &c., by Hartman Schopperum, printed at Frankfort-on-the-Maine in 1548, about twenty years after the Reformation: this old work contains 180 highly characteristic engravings, cut plank-ways on wood, and taken from every grade of life, civil, religious, and military, not forgetting the liberal and constructive arts, amongst which are included that of the turner, and those of a variety of artisans whose pursuits are intimately allied to our present subject. This work, which will be again referred to, shows that a great degree of perfection and subdivision in the practice of the mechanical arts existed even at that early period.

The execution of Plumier's work is honorable to its author, from the industrious care and exactness which it exhibits, more especially when it is considered that it is almost the first work published upon the subject: a second edition, with extra plates, and additional text, was published in Paris, 1749, when it also appeared in folio. It formed the basis of the article on the art of Turning, published in 1791, in "*l'Encyclopédie Méthodique*," (begun in 1782,) by Diderot, D'Alembert, and others, wherein forty crowded engravings of turning machinery are contained: various other French works on the same subject quickly followed.

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* It is rather singular that not only Plumier's, but all the subsequent French and English works, written exclusively on turning (except Rich's,) should be absent from that extensive and national collection of books.

First, the earlier edition of the "*Manuel du Tourneur*," 2 vols. quarto, 1792-4, Paris, by L. E. Bergeron; this work is highly satisfactory, and is a record of all the material improvements introduced in the mechanism of the lathe by our Continental neighbours, subsequent to the period at which Plumier wrote; and from these machines many of our modern contrivances are taken, although during the interval which has since elapsed, considerable changes have been introduced, as well in the manner of turning as in the material of the apparatus, wood being in many cases supplanted by metal, a more useful change as regards the excellence of construction, and also the strength and durability of the machinery.

A second edition of Bergeron's work, revised by his son-in-law, Hamelin Bergeron, was published in 1816; another smaller publication, entitled "*L'Art du Tourneur, par M. Pauline Desormeux*," in 2 vols. 12mo, with an atlas, was printed in Paris in 1824; and lastly, two small volumes 16mo, with plates, entitled "*Nouveau Manuel du Tourneur, ou Traité complet et simplifié de cet Art, rédigé par M. Dessables*," the second edition of which, printed in 1839, and forming a part of the "*Encyclopédie-Roret*," completes the list of French works devoted to the subject, the last two being in some respects compilations from Bergeron; the latter works only include the practice of hand-turning, leaving unnoticed the rose-engine, the eccentric-chuck, and various apparatus described in the old books, although the "*Manuel-Roret*" contains, in an appendix, some extracts relative to the art of turning, from more recent scientific journals, and the printed transactions of various societies, with explanatory notes, by Mapod, "*Tourneur-mécanicien*."

In England, where, during the last half-century, the art has perhaps been far more extensively practised, both as a source of emolument and of amusement, we find in addition to the brief articles in the various encyclopædias, periodicals, and a few works devoted to mechanical subjects, only the following treatises on detached portions of the art, namely:

1817. "Specimens of Eccentric Circular Turning, with Practical Illustrations for producing Corresponding Pieces in that Art. By John Holt Ibbetson, Esq."

1819. "Specimens of the Art of Ornamental Turning, in Eccentric and Concentric Patterns, with 6 copper-plate engravings; by Charles H. Rich, Esq., Southampton."

1819. "Tables; by which are exhibited at one view all the divisions of each circle on the dividing plate. By C. H. Rich, Esq."

1825. A second edition of Ibbetson's Specimens.

1833. "A Brief Account of Ibbetson's Geometric Chuck, manufactured by Holtzapffel & Co., with a selection of 32 Specimens, illustrative of some of its powers. By J. H. Ibbetson, Esq."*

1838. A third edition of Ibbetson's Specimens of Eccentric Circular Turning. "With considerable Additions, including a description and copperplate engravings of the Compound Eccentric Chuck, constructed by the Author, and used by him in the execution of his Specimens."

The mention of the above publications by Mr. Ibbetson, enables me to particularize the services he has rendered to his fellow amateurs; and their inspection will abundantly show the great care and perseverance that he has devoted to the pursuits of turning, and the deserved eminence he has attained therein.

He has not only attended to the production of numerous highly ornamental combinations and effects, many of which are displayed in the treatises before cited; others in his "Practical View of an invention for the better protecting Bank Notes against Forgery," editions 1 and 2,—1820 and 21, and in numerous communications to the Mechanics' Magazine; he has done more than this by constructing with his own hands the major part of the apparatus that he has used, many of which are original, and will be duly noticed in their appropriate places, in this work.

The best notices in our language of the *general* application of the art, are probably those contained in Rees's Cyclopædia, under the heads of "Turning," "Lathe," and "Rose Engine."

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* For Mr. Ibbetson's first description of his modification of the Geometric Chuck, see Mechanics' Magazine, 30th Dec., 1826.

Several amateurs have undertaken the translation of Bergeron's Manuel into the English language, and others have commenced new works, but none of these have been carried to completion. The former proceeding would have called for a re-construction of the book, which, although it abounds with a great deal of original, useful, and practical matter, is rather diffuse, and refers to apparatus that has been so far altered and superseded by others of more recent construction, and subsequent invention, that such a translation, if adapted to the present state of the art, would almost amount to a new work.

The author of these pages has been repeatedly urged, by many amateurs, to write a work upon the subject, but by no one more than by his late father, in conjunction with whom he made several beginnings; but the pressure of other business has prevented their efforts from arriving at maturity, and the delay has been materially lengthened by the difficulty of determining upon the most suitable arrangement. The first intention was to have written the book as a series of lessons; to have begun with the description of the plain or simple lathe, and so to have selected the examples, as to have successively described the more important and valuable of those instruments and methods which are now used.

The writer still pursued the same views after the loss of his father, in 1835, and the work was somewhat advanced on that plan, but ultimately abandoned, as he found the information upon each individual topic would then be scattered, difficult of reference, and introduced without any apparent order. That arrangement of the work would also have prevented him from introducing the notice of many useful contrivances, and from instituting a variety of comparisons between different methods, the insertion of which would greatly facilitate the explanations, and present a choice of proceeding.

Moreover, as the art now embraces a much more extensive and still increasing range of objects and instruments, than it did at the time when Bergeron wrote, the difficulties of arrangement that he experienced, are now proportionally increased. The author also felt some doubt as to his ability to produce, upon the first method, a work that should satisfactorily meet the wants of amateur turners generally, in reflecting upon the widely different views with which they had, even for some centuries, practised turning and the mechanical arts.

Many persons have pursued these arts as a source of active and industrious employment, accessible at all hours, in the intervals between their other pursuits: a source of amusement that renders the amateur independent of the ordinary artizan for the supply of a great variety of works of utility for the common wants of life, including those constantly required either for the domestic establishment, or those personally experienced by its inhabitants, of every age or choice of occupation.

Other amateurs have pursued the art of turning as a source of elegant recreation, and of inventive and skilful pastime; one closely allied to the fine arts, inasmuch as its greatest success depends upon a just appreciation of sculpture and painting, and for the attainment of which the education and opportunities of the man of independent leisure eminently qualify him; whilst the embellishment of the drawing-room, cabinet, and boudoir, stimulate him to apply his knowledge and skill to that end, and in which he frequently administers at the same time to the extension and cultivation of tasteful form in ordinary manufactures.

There is also a class of amateurs who have preferred the pursuit of such branches of the art as unite, with taste and design, a certain admixture of the more exact acquirements connected with mathematical and general science, and the arts of construction; and who have devoted their time and ingenuity to the production of models, embracing a variety of objects relative to the arts of peace and war; and also various machines and apparatus, or in the still more praiseworthy attempt of improving those already in use, or of inventing new ones; and the services that have been thus rendered by men of independence and education are neither few nor slight. In all such cases the progress is more rapid and certain, when the pencil is devoted to the production of the drawing, and the tool to the formation of the rough model, as proceedings in common, prior to making the finished apparatus.

In selecting topics from the very numerous branches of the subject, the author has endeavoured to supply the more immediate wants of all classes of amateurs, and under these circumstances he has thought it best, for the convenience and choice of the general reader, to separate the practical division of the subject of Turning into three distinct and different parts, to be preceded by two general or preliminary volumes, to contain miscellaneous information required nearly alike in the pursuit of every branch of the mechanical arts; thus dividing the entire work into five volumes—namely,

Vol. I.
Materials, their Differences, Choice, and Preparation; various Modes of Working them, generally without Cutting Tools.

Vol. II.
The Principles of Construction, and Purposes of Cutting Tools; Abrasive and Miscellaneous Processes.

Vol. III.
The Principles and Practice of Hand or Simple Turning,

Vol. IV.
The Principles and Practice of Ornamental or Complex Turning.

Vol. V.
The Principles and Practice of Amateur Engineering.

The first volume, which is now in the hands of the reader, relates principally, to the materials for turning and the mechanical arts, arranged under the heads of the three great sources from which they are respectively derived; namely, the vegetable, the animal, and the mineral departments of nature; it includes also their treatment in the extended sense of the word, so far as regards their preparation for the Lathe, and their employment in various distinct branches of mechanical art, the practices of which do not in general require the use of tools with cutting edges.

The metallic materials are submitted to the greatest variety of processes, and which mainly depend on their properties of fusibility, malleability, and ductility; and consequently, the formation and qualities of alloys are considered, as also the arts of founding and soldering; those of forging works in iron and steel which are comparatively thick, and the nearly analogous treatment of thin works, or those in sheet metals; drawing tubes and wires, hardening and tempering, and a variety of co-relative information is also offered, for the particulars of which the reader is referred to the Table of Contents.

The second volume, on cutting tools, and abrasive processes, is intended first to explain the general principles of cutting tools, which are few and simple; the forms and proportions of tools are however extensively modified, to adapt them to the different materials; to the various shapes to be produced; and to the convenience of the operator, or of the machine in which they are fixed. The remarks on the tools will inevitably be somewhat commingled with the account of their practical use, and the consideration of the machines with which they are allied, as indeed it is difficult to say where the appellation of *tool* ends, and that of *machine* or *engine* begins. The tools will be treated in different chapters, on Chisels and Planes, Turning Tools, Boring Tools, &c., as before enumerated.

The subsequent part of the second volume will be devoted to the description of abrasive processes; namely, those for restoring or sharpening the edges of the cutting tools; those for working upon substances to which, from their hardness or crystalline structure, the cutting tools are quite inapplicable; and also to the modes of polishing, which may be viewed as a delicate and extreme application of the abrasive process, and the final operation after the cutting tools; and lastly, to the ordinary modes of staining, lackering, varnishing, and other miscellaneous subjects.

The titles of volumes III., IV., and V., are it is expected sufficiently descriptive of their contents, which will be arranged with a similar attempt at order and classification, upon which it is unnecessary here to enlarge. From the systematic arrangement which has been attempted throughout the five volumes, it is hoped that instead of the numerous descriptions and instructions, being indiscriminately mixed and scattered, they will assume the shape of so many brief and separate treatises, and will in a great measure condense into a few consecutive pages, the remarks offered under each head; a form that will admit of any subject being selected, and of a more easy and distinct *reference* and *comparison*, when the reader may find it necessary; a facility that has been particularly studied.

Each of the five volumes may be considered as a distinct work and complete in itself; this will admit of any selection being made from their number. At the same time it is to be observed that the first and second are written as accompanying volumes, and will have an index in common, so as to constitute a general and preliminary work; the addition to which, of one of the other volumes, will render the subject complete for each of the three classes of amateurs before referred to, should the entire work be deemed too extensive.

CHAPTER II.

MATERIALS FROM THE VEGETABLE KINGDOM.

SECT. I.—THEIR GROWTH, STRUCTURE, AND PREPARATION.

THE materials used in turning and the mechanical arts are exceedingly numerous: we obtain from the Vegetable Kingdom an extensive variety of woods of different characters, colours, and degrees of hardness, and also a few other substances.

The most costly and beautiful products of the Animal Kingdom, are the tusks of the elephant, the tortoise and pearl shells; but the horns, hoofs, and some of the bones of the ox, buffalo, and other animals, are also extensively used for more common purposes.

From the Mineral Kingdom are obtained many substances which are used in their natural states, and also the important products of the metallic ores.

It would be altogether misplaced to attempt a minute and general description of these varied materials, as they will be found in their more appropriate places in works on natural history, physiology, mineralogy, and metallurgy; and it is the less necessary, as those which are more commonly used, are familiar to us in the buildings, machinery, implements, furniture, and ornaments, by which we are surrounded: others of less extensive supply are, in many respects, only varieties which are subject to similar usage. I shall therefore principally restrict myself, to the description of those characters of the usual materials which lead the artizan to select them for his several purposes, and that also direct the choice of the tools by means of which they are respectively worked.

By far the most numerous and important of the materials from the Vegetable Kingdom are the woods, with which most parts of our globe are abundantly supplied; great numbers of them are used in their respective countries, and are known to the naturalist, although but a very inconsiderable portion of them are familiar to us in our several local practices.

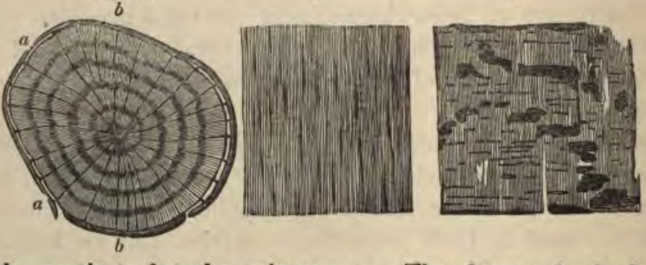
The woods that are the most commonly employed in this country, are enumerated in an alphabetical list, together with the most authentic information I could obtain concerning them; in collecting which, the assistance of various kind friends has been obtained, amongst whom are numbered travellers, naturalists, merchants, and manufacturers. Various museums, collections, and works, have been carefully examined, so as to include in the list, the more important of the various names of the woods, their countries, general and mechanical characters, and their principal uses in the arts of construction.

The alphabetical catalogue is preceded by a tabular view, intended to classify the woods that are the most generally selected by our artizans for certain ordinary uses; it will also serve, in a slight degree, to throw them into groups according to some of the differences between them, referable principally to their fibrous structures, by which they are distinguished as hard or soft, elastic or non-elastic, of plain or variegated appearance, of permanent figure or the reverse.

Their other varieties, in respect to colour and scent, and the oils, resins, gums, medicinal and various other matters, they respectively contain, are questions of equal importance, but they are more connected with the chemical and economic arts, and but slightly concern this inquiry. I shall therefore, nearly restrict myself to the questions arising from the mechanical structure and treatment of the woods, which it is proposed to consider under separate heads, in the present and three following chapters.

The general understanding of the principal differences of the woods will be greatly assisted by a brief examination into their structure, which is now so commonly and beautifully developed by the sections for the microscope. The figures 1, 2, 3 are drawn from thin cuttings of beech-wood, prepared by the opti-

Figs. 1. 2. 3.



cian for that instrument; the principal lines alone are represented, and these are magnified to about twice their linear distances, for greater perspicuity.

Fig. 1, which represents the horizontal or transverse section of a young tree or a branch, shows the arrangement of the annual rings around the center or pith; these rings are surrounded by an exterior covering, consisting also of several thinner layers, which it will suffice to consider collectively, in their common acceptation, or as the bark. The fibres which are seen as rays proceeding from the pith to the bark, are the medullary rays or plates.

Figs. 2 and 3 are vertical sections of an older piece of beechwood. Fig 2 is cut through a plane, such as from *a* to *a*, in which the edges of the annual rings appear as tolerably parallel fibres running in one direction, or lengthways through the stem; the few thicker stripes are the edges of some of the medullary rays.

Fig. 3 is cut radially, or through the heart, as from *b* to *b*. In this the fibres are observed to be arranged in two sets, or to run crossways; there are first the edges of the annual rings, as in fig. 2, and secondly, the broad medullary rays or plates.

The whole of these figures, but especially the last, show the character of all the *proper* woods, namely, those possessing *two sets of fibres*, and in which the growth of the plant is accomplished, by the yearly addition of the external ring of the wood, and the internal ring of the bark, whence these rings are called annual rings, and the plants are said to be *exogenous*, from the growth of the *wood* being external.

In fig. 1 the medullary rays are the more distinctly drawn, in accordance with the appearance of the section, as they seem to constitute more determinate lines; whereas the annual rings consist rather of series of tubes arranged side by side, and in contact with each other, and which could not be represented on so small a scale. At the outer part of each annual ring these tubes or pores appear to be smaller and closer; the substance is consequently more dense, from the greater proportion of the matter forming the walls of the tubes; and the inner or the softer parts of the annual rings have in general larger vessels, and therefore less density.

In many plants the wedge-form plates, intermediate between the medullary rays, only appear as an irregular cellular tissue full of small tubes or pores, without any very definite arrangement*. The medullary rays constitute however, the most characteristic part of the structure, and greatly assist in determining the difference between the varieties of the exogenous plants, as well as the wide distinction between the entire group and those shortly to be described. The medullary rays also appear, by their distinct continuity, to constitute the principal source of *combination* and strength in the substance of the woods; most of the medullary rays, in proceeding from the center to the circumference, divide into parts to fill out the increased space.

In the general way, the vertical fibres of the annual rings, and the horizontal fibres of the medullary rays, are closely and uniformly intermingled; they form collectively the substance of the wood, and they also constitute two series of minute interstices, which are viewed to be either separate cells or vessels, the majority ef which proceed vertically, the others radially. In many, as the oak, sycamore, maple, and sweet chesnut, the medullary rays, when dissected, exhibit a more expanded or foliated character, and pervade the structure, not as simple radial tubes, but as broad *septæ* or divisions, which resemble flattened cells or clefts amongst the general groups of pores, giving rise to the term *silver-grain*, derived from their light and glossy appearance: they vary considerably in size and number.

The beechwood, fig. 3, has been selected as a medium example between this peculiarity and the ordinary crossings of the fibres, which in the firs and several others seem as straight as if they were lines mechanically ruled; and even in the most dense woods are in general easily made out under the microscope.

The vessels or cells running amidst the fibres are to the plant what the blood-vessels and air-cells are to the animal; a part of them convey the crude sap from the roots, or the mouths of the plant, through the external layers of the wood to the leaves, in which it is evaporated and prepared; the fluid afterwards returns through the bark as the elaborated sap, and combines with that in the external layers of the wood, the two constituting the *cambium*. The latter ultimately becomes consolidated for the production of the new annual ring that is deposited beneath the loosened bark, and which is eventually to constitute a part of the general substance or wood; the bark, also receives a minute addition yearly, and the remainder of the fluid returns to the earth as an excretion *.

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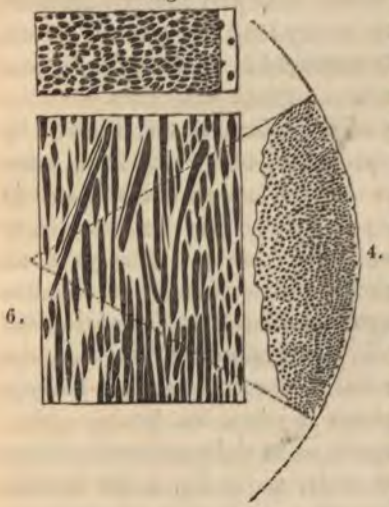
* In the *Cissampelos Pareira*, belonging to the natural order *Menispermaceæ*, this structure is singularly evident; the medullary rays are very thick, and almost detached from the intermediate wedge-form plates, which are nearly solid, except the few pores by which they are pierced, much like the substance of the common cane.

The other order of plants grows in an entirely different manner, namely by a deposition from within, whence they are said to be *endogenous;* these include all the grasses, bamboos, palms, &c. *Endogens* are mostly hollow, and have only one set of fibres, the vertical, which appear in the transverse section, (fig. 4,) as irregular dots closely congregated around the margin, and gradually more distant towards the center, until they finally disappear, and leave a central cavity, or a loose cellular structure. Fig. 5 represents the horizontal, and fig. 6 the vertical section of portions of the same, or the cocoa-nut palm, (*Cocos nucifera,*) of half their full size.

Fig. 5.



All the *endogens* are considered to commence from a circular pithy stem which is entirely solid; some, as the canes, maintain this solidity, with the exception of the tubes or pores extending throughout their length. The bamboos extend greatly in diameter, so as to become hollow, except the diaphragms at the knots; these are often used as cases for rolls of papers. The palms generally enlarge still more considerably to their extreme size, which in some cases is fifty times the diameter of the original stem, the center being soft and pithy.

Some of the palms, &c. denote each yearly increase by one of the rings or markings upon their stems, which are always soft in the upper part, like a green vegetable, and terminate in a cluster of broad pendent leaves, generally annual, and when they drop off they leave circular marks upon the stem, which are sometimes permanent, and indicate by their number the age of the plant. The vertical fibres above referred to, proceed from the leaves, and are considered to be analogous to their roots, and likewise to assimilate in function to the downward flow of the sap from the leaves of the *exogens:* whereas in the palms they constitute separate and detached fibres, that first proceed inwards, and then again outwards, with a very long and gradual sweep, thereby causing the fibres to be arranged in part vertically, and partly inclined, as in the figure*.

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* The reader will find the articles in the three Editions of Dr. Lindley's Introduction to Botany, "*Exogenous structure,*" and "*Of the stem and origin of wood;*" and also "*Exogens,*" and "*Endogens,*" by the same author in the Penny Cyclopedia, replete with physiological interest.

The substance of the stems of the palms, is not allowed by physiological botanists to be proper wood, (which in all cases grows exteriorly, and possesses the two sets of fibres shown in fig. 3;) whereas the *endogenous* plants have only the one set, or the vertical fibres; and although many of this tribe yield an abundance of valuable gifts to the natives of the tropical climates in which they flourish, only a portion of the lower part of the *shell* of the tree is available as wood; amongst other purposes, the smaller kinds are used by the natives as tubes for the conveyance of water, and the larger pieces as joists, &c. &c.

The larger palms generally reach us in slabs measuring about the sixth or eighth part of the circle, as in fig. 4, the smaller sizes are sent entire; fig. 5 represents a small piece near the outside, with the fibres half size; but the different palms vary considerably in the shapes, magnitudes and distances of the fibres, and the colours and densities of the two parts.

In the vertical section, fig. 6, which is also drawn half size, the fibres look like streaks or wires embedded in a substance similar to cement or pith, which is devoid of fibrous structure; the inhabitants of the Isthmus of Darien pick out the fibres from some of the palms and use them as nails, they are generally pointed, and in the specimens from which the drawing was made, they are as hard as rosewood, whereas the pithy substance is quite friable. Some of the smallest palms are imported into this country for walking-sticks, under the names of partridge and

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* The leaves of the exogens are by some thought to send down similar roots or fibres, between the bark and wood for the formation of the annual ring.

Penang canes, &c. The ordinary canes and bamboos are too well known to require more than to be named.—See article PALMS, in the catalogue.

To return to the more particular examination of the woods that most concern us, it will be observed that the central pith in fig. 1, happens to be of an irregular triangular shape. This, the primary portion of the plant, is in the first instance always cylindrical; it is supposed to assume its accidental form, (which is very frequently hexagonal,) from the compression to which it is subjected. The pith governs, in a considerable degree, the general figure or section, as all the series of rings will be observed, in fig. 1, page 14, to have a disposition to project at three points; but with the successive additions, the angular form is gradually lost, as it would be if we wound a ribbon upon a small triangular wire; for after a time, no material departure from the circular form would be observable.

A greater variation amongst the rings is due to the more or less favourable growth of the successive years, and to the different exposure of the tree to the sun and air, which develop that side of the plant in an additional degree; whereas the tree growing against a wall or any other obstruction, becomes remarkably stunted on that side of its axis, from being so shielded.

The growth of a tree is seldom so exactly uniform that its section is circular, or its heart central, often far from it; and as each of the annual rings is more consolidated, and of a deeper colour on its outer surface, they frequently serve to denote very accurately, in the woods growing in cold and temperate climates, the age of the plant, the differences of the seasons, the circumstances of its situation, and the general rapidity of its growth. "But in many hot countries the difference between the growing-season and that of rest, if any occur, is so small, that the zones are, as it were, counfounded, and the observer finds himself incapable of distinguishing with exactness the formation of one year from that of another*."

It is, however, difficult to arrive at any satisfactory conclusion respecting the qualities of woods, from the appearance of their annual rings; for instance, in two specimens of larch, considered by Mr. Fincham† to be exceedingly similar, in specific gravity, strength and durability; in the one, Scotch larch, there were three annual rings in five-eighths of an inch, whereas in Italian larch there were twenty-four layers in the same space. In some of the tropical woods the appearance of the rings can scarcely be defined, and in a specimen of the lower or butt end of teak, now before me, three annual rings cover the great space of one inch and three-eighths.

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* Dr. Lindley's Introduction to Botany, second edition, p. 74.

† Principal builder of Her Majesty's Dock-yard, Chatham.

The horizontal section of a tree, occasionally looks as if it were the result of two, three, or more separate shoots or stems consolidated into one; in some of the foreign woods in particular, this irregularity often gives rise to deep indentations, and most strange shapes, which become eventually surrounded by one single covering of sap; so that a stem of considerable girth may yield only an insignificant piece of wood, scarcely available for the smallest purposes of turnery, much less for cabinet work*.

The circulation of the sap is considered to be limited to a few of the external layers, or those of the sap-wood, or *alburnum*, which are in a less matured state than the perfect wood, or *duramen*, beneath. The last act of the circulation, as regards the heart-wood, is supposed to be the deposition of the colouring matter, resin or gum, through the agency of the medullary rays, that proceed from the bark towards the center, and leave their contents in the layer outside the true wood perfected the year previous. We may fairly suppose by analogy, that as one ring is added each year, so one is perfected annually, and thrown out of the circulatory system.

That the circulation has ceased in the heart-wood, and that the connexion between it and the bark has become broken, is further proved by the fact, that numbers of trees may be found in tolerably vigorous growth within the bark, whereas at the heart they are decayed and rotten. In fact some of the hardest foreign woods, as king-wood, tulip-wood, and others, are rarely sound in the center, and thus indicate very clearly that their decay commenced whilst they were in their parent soil; and as in these, the appearance of annual rings is scarcely to be made out, this also appears to indicate a great term of age, enough to account for this relatively premature decay.

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* This is not peculiar to the tropical woods; for example, some of the yew-trees in Hampton Court gardens, appear to have grown in this manner from three or four separate stems, that have joined into one a short distance above the ground. As an instance of the singular manner in which the separate branches of trees thus combine, I may mention that stones and pieces of metal, &c., are occasionally met with in the central parts of timber, from having been accidentally deposited in a cleft, or the fork of a branch, and entirely enclosed or overgrown by the subsequent increase of the plant.

The quantity of sap-wood is various in different plants, and the line of division is usually most distinctly marked; in some, as boxwood, the sap-wood is very inconsiderable, and together with the bark is on the average only about the thickness of a stout card, whereas in others, as the snake-wood, it constitutes fully two-thirds of the diameter, so that a large tree yields but an inconsiderable stick of wood, of one third or fourth the external diameter.

It may be presumed that in the same variety of wood, about an average number of the layers exist as sap-wood, as in cutting up a number of pieces of the same kind, such as the black Botany-Bay wood, and others, it is found that in those measuring about two inches diameter, the piece of heart-wood is only about as large as the finger, but in pieces one, two, or three inches larger, the heart-wood is also respectively one, two or three inches larger, or nearly to the full extent of the increase of the diameter.

The sap-wood may be therefore, in general, considered as of about an average thickness in each kind of wood: it is mostly softer, lighter, more even in colour, and more disposed to decay than the heart-wood, which prove it to be in a less matured or useful state, whether for mechanical or chemical purposes.

At the time the tree is separated from its root, its organic life ceases, and then commences the gradual evaporation of the sap, and the drying and contracting of the tubes, or tissues, previously distended by its presence.

The woods are in general felled during the cold months, when the vegetative powers of the plant are nearly dormant, and when they are the most free from sap; but none of the woods are fit for use in the state in which they are cut down, for although no distinct circulation is going on within the heart-wood, still the capillary vessels keep the trees continually moist throughout their substance, in which state they should not be employed.

If the green or wet woods are placed in confined situations, the tree or plank, first becomes stained or doated, and this speedily leads to its decomposition or decay, effects that are averted by careful drying with free access of air*.

Other mischiefs almost as fatal as decay also occur; blocks cut out of the entire circular stem of green wood, or the same pieces divided into quarterings, split in the direction of the medullary rays, or radially, also though less frequently upon the annual rings. The entire sections or round blocks contract pretty equally, and retain their circular form, but the quarterings become oval from their unequal shrinking.

As a general observation it may be said the woods do not alter in any material degree in respect to length. Boards and flat pieces contract however in width, they warp and twist, and when they are fitted as panels into loose grooves, they shrink away from that edge which happens to be the most slightly held; but when restrained by nails, mortices, or other unyielding attachments, which do not allow them the power of contraction, they split with irresistible force, and the materials and labour thus improperly employed will render no useful service.

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* On this account the timbers for ships are usually cut out to their shape and dimensions for about a year before they are framed together, and they are commonly left a twelvemonth longer in the skeleton state, to complete the seasoning, as in that condition they are more favourably situated as regards exposure to the air than when they are closely covered in with the planking.

Mr. Fincham considers that the destruction of timber by the decay commonly known as dry-rot, cannot occur unless air, moisture, and heat, are each present, and that the entire exclusion of any of the three stays the mischief. By way of experiment, he bored a hole in one of the timbers of an old ship built of oak, whose wood was at the time perfectly sound; the admission of air, the third element, to the central part of the wood, (the two others being to a certain degree present,) caused the hole to be filled up in the course of twenty-four hours with mouldiness, a well-known vegetation, which very speedily became so compact a fungus as to admit of being withdrawn like a stick. He considers the shakes in timber to predispose it to decay, in damp and confined situations, from admitting the air in the same manner.

The woods differ amazingly in their resistance to decay; some perish in one or two years, whereas others are very durable, and even preserve their fragrance when they are opened after many years, or almost centuries.

Mr. G. Loddiges says, the oak boxes, for the plants in his green-houses, decay in two or three years, whereas he has found those of teak to last fully six or seven times as long: the situation is one of severe trial for the wood.

The process of Kyanizing is intended to prevent the re-vegetation of timber, by infusing into its pores an antiseptic salt: the corrosive sublimate is generally employed, other metallic salts are also considered to be applicable, but the general utility of the process, especially in thick timbers, or those exposed to much wet, is still unsettled amongst practical men.

The Kyanizing is sometimes done in open tanks, at others, (by Timperley's process, Hull and Selby Railway,) in close vessels from which the air is first exhausted to the utmost, and the fluid is then admitted under a pressure of about 100 pounds on the inch.—*See* Minutes of Proceedings Inst. Civ. Eng., p. 83, 1841.

There are two quarto works on dry-rot; the one by Mr. M'William, 1818; the other by Mr. John Knowles, Surveyor of Her Majesty's Navy, 1821.

In general, the softest woods shrink the most in width, but no correct observations on this subject have been published. Mr. Fincham considers the rock-elm to shrink as much as any wood, namely, about half an inch in the foot, whereas the teak scarcely shrinks at all; in the "Tortoise" store-ship, when fifty years old, no openings were found to exist between the boards.

In the woods that have been partially dried, some of these effects are lessened when they are defended by paint or varnish, but they do not then cease, and with dry wood, every time a new surface is exposed to the air, even should the work have been made for many years, these perplexing alterations will in a degree recommence, even independently of the changes of the atmosphere, the fluctuations of which the woods are at all times too freely disposed to obey.

The disposition to shrink and warp from atmospheric influence, appears indeed to be never entirely subdued; some bog-oak, supposed to have been buried in the island of Sheppy, not less than a thousand years, was dried for many months, and ultimately made into chairs and furniture; it was still found to shrink and cast, when divided into the small pieces required for the work.

SECT. II.—SEASONING AND PREPARING THE WOODS.

HAVING briefly alluded to the mischiefs consequent upon the use of woods in an improper condition, I shall proceed to describe the general modes pursued for avoiding such mischiefs by a proper course of preparation.

The woods immediately after being felled, are sometimes immersed in running water for a few days, weeks, or months, at other times they are boiled or steamed; this appears to be done under the expectation of diluting and washing out the sap, after which it is said the drying is more rapidly and better accomplished, and also that the colours of the white woods are improved, (see article HOLLY in Catalogue, also EBONY,) but the ordinary course is simply to expose the logs to the air, the effect of which is assisted by the preparation of the wood into smaller pieces, approaching to the sizes and forms in which they will be ultimately used, such as square logs and beams, planks or boards of various thicknesses, short lengths or quarterings, &c.

The stems and branches of the woods of our own country, such as alder, birch, beech, &c., that are used by the turner, frequently require no reduction in diameter; but when they are beyond the size of the work, they are split into quarterings and stacked in heaps to dry, which latter proceeding should never be forgotten under any circumstances.

We know but little of the early treatment of the foreign woods used for cabinet-work and turning; some few of them, as mahogany and satin-wood, are imported in square logs; others, as rosewood, ebony, Coromandel, &c., are sometimes shipped in the halves of trees, or in thick planks; but the generality of those used for turning are small, and do not require this reduction; these only reach us in billets, sometimes with the rind or bark upon them, and sometimes cleaned or trimmed.

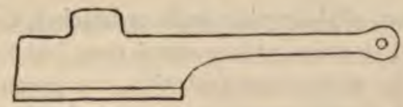
The smaller hard woods are very much more wasteful than the timber woods; in many of the former, independently of their thick bark, the section is very far from circular, as they are often exceedingly irregular, indented, and ill-defined; others are almost constantly unsound in their growth, and either present central hollows and cavities, or cracks and radial divisions, which separate the stem into three or four irregular pieces.

Probably none of the hard woods are so defective as the black Botany-Bay wood, in which the available produce, when it is trimmed ready for the lathe, may be considered to be about one third or fourth of the original weight, sometimes still less; but unfortunately many others approach too nearly to this condition, as a very large proportion of them partake of the imperfections referred to, more especially the cracks; the larger hard woods are by comparison much less wasteful.

All the harder woods require increased care in the seasoning, which is often badly begun by exposure to the sun or hot winds in their native climates: their greater impenetrability to the air the more disposes them to crack, and their comparative scarcity and expense, are also powerful arguments on the score of precaution. It is therefore desirable to prepare them for the transition from the yard or cellar to the turning room, by removing the parts which are necessarily wasted, the more intimately to expose them to the air before removal, and they should be always kept away from the fire, or at first in a room altogether without one.

It is usual to begin by cutting the logs into pieces of eight or ten inches, or other lengths suited to the general size of the work; and if possible to prepare each piece into a round block, or into two or three, when the wood is irregular, hollow, or cracked. In the latter case, a thin wedge is inserted into the principal crack, and driven down with a wooden maul; or a cleaver such as fig. 7, which has a sharp edge, and a poll to receive the blow, is used in the same manner; these tools, or the hatchet, are likewise used in splitting up the English woods, when they are beyond the diameters required*. The cleft pieces are next roughly trimmed with the hatchet, or else with the paring-knife, a tool of safer and more economical application in the hands of the amateur: it is a lever knife, (the half of a pair of shears,) from two and a half, to three feet long; the cutting edge is near the end which terminates in a hook, the other extremity has a transverse handle; an eye-bolt is screwed into the bench or block for the hook, and a detached cutting board is fixed under the blade, to serve as the support for the wood, and for the knife to cut upon. To avoid waste of material, it is advisable to score with the compasses, upon each end of the rough block, as large a circle as it will allow, to serve as a guide for the knife, until the eye is well accustomed to the work.

Fig. 7.



The block, represented in fig. 8, is adapted to the bearers of the lathe, but any other support will serve equally well. The paring-knife is also employed for other purposes besides those of the turner: it is sometimes made with a curved edge like a

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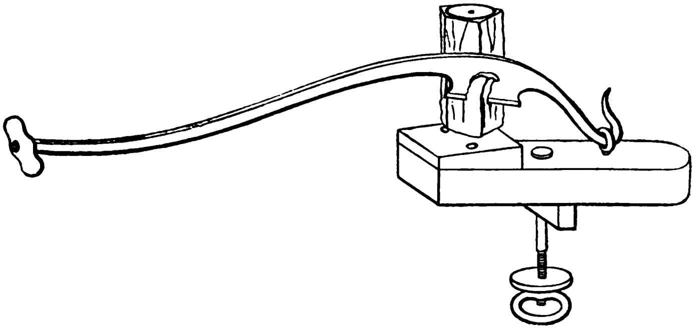
[*] Sometimes the glazier's chipping-knife is used for small pieces of wood instead of the cleaver represented.

gouge, and is used in many shaping operations in wood, as in the manufacture of shoe-lasts, clogs, pattens, toys, &c. &c.*

Fig. 8.



In the absence of the paring-knife or hatchet, the work is fixed in the vice, and rounded with a coarse rasp, but this is much less expeditious: by some manufacturers the preparation both of the foreign and English woods is prosecuted still further, by cutting the material into smaller pieces, rough turned and hollowed in the lathe, to the form of boxes, or other articles for which they are specifically intended, and in fact every measure that tends to make the change of circumstances gradual, assists also in the economy, perfection, and permanence of the work.

Many of the timber woods are divided at the saw-pit into planks or boards, at an early stage, in order to multiply the surfaces upon which the air may act, and also to leave a less distance for its penetration: after sawing, they should never be allowed to rest in contact, as the partial admission of the air often causes stains or doating: but they are placed either perpendicularly or horizontally in racks, or they are more commonly stacked in horizontal piles, with parallel slips of wood placed between at distances from about three to six or eight feet, according to the quantity of support required; the pile forms a press to keep the whole flat and straight.

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* A paring-knife similar to the above, but working in a guide, and with an edge 12 or 14 inches long, is a most effective instrument in the hands of the toy-makers. The pieces of birch, alder, &c. are boiled in a cauldron for an hour to soften them, and whilst hot they may be worked with great expedition and perfection. The workmen pare off slices, the plankway of the grain, as large as 4 by 6 inches, almost as quickly as they can be counted: they are wedged tight in rows, like books, to cause them to dry flat and straight, and they seldom require any subsequent smoothing. In making the little wheels for carts, &c., say of one or two inches diameter, and one-quarter or three-eighths of an inch thick, they cut them the *crossway of the grain*, out of cylinders previously turned and bored; the flexibility of the hot moist wood being such, that it yields to the edge of the knife without breaking transversely as might be expected.

Thin pieces will be sufficiently seasoned in about one year's time, but thick wood requires two or three, before it is thoroughly fit to be removed to the warmer temperature of the house for the completion of the drying. Mahogany, cedar, rosewood, and the other large foreign woods, require to be carefully dried after they are cut into plank, as notwithstanding the length of time that sometimes intervenes between their being felled and brought into use, they still retain much of their moisture whilst they remain in the log*.

In some manufactories the wood is placed for a few days before it is worked up, in a drying room heated by means of stoves, steam, or hot water, to several degrees beyond the temperature to which the finished work is likely to be subjected.

Such rooms are frequently made as air-tight as possible, which appears to be a mistake, as the wood is then surrounded by a warm but stagnant atmosphere, which retains whatever moisture it may have evaporated from the wood. Of late a plan has been more successfully practised in seasoning timber for building purposes, by the employment of heated rooms with a free circulation of air, which enters at the lower part in a hot and dry state, and escapes at the upper charged with the moisture which it freely absorbs in the heated state. The continual ingress of hot dry air, greedy of moisture, so far expedites the drying, that it is accomplished in one-third of the time that is required in the ordinary way in the open air†.

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* Scientifically considered, the drying is only said to be complete when the wood ceases to lose weight from evaporation; this only occurs after twice or thrice the period usually allowed for the process of seasoning.

In many modern buildings small openings are left through the walls to the external air to allow a partial circulation amidst the beams and joists, &c., as a preservative from decay, and for the entire completion of the seasoning.

† Price's Patent.

CHAPTER III.

USEFUL CHARACTERS OF WOODS.

SECT. I.—HARD AND SOFT WOODS, ETC.

THE relative terms hard and soft, elastic or non-elastic, and the proportions of resins, gums, &c., as applied to the woods, appear to be in a great measure explained by their examination under the microscope, which develops their structure in a very satisfactory manner.

The fibres of the various woods do not appear to differ so materially in individual size or bulk, as in their densities and distances: those of the soft woods, such as willow, alder, deal, &c., appear slight and loose; they are placed rather wide asunder, and present considerable intervals for the softer and more spongy cellular tissue between them; whereas in oak, mahogany, ebony, rose-wood, &c., the fibres appear rather smaller, but as if they possessed a similar quantity of matter (just as threads containing the same number of filaments are larger or smaller, according as they are spun). The fibres are also more closely arranged in the harder woods, the intervals between them are necessarily less, and the whole appears a more solid and compact formation.

The very different tools used by the turner for the soft woods and hard woods respectively, may have assisted in fixing these denominations as regards his art; a division that is less specifically entertained by the joiner, who uses the same tools for the hard and soft woods, excepting a trifling difference in their angles and inclinations; whereas the turner employs for the soft woods, tools with keen edges of thirty or forty degrees, applied obliquely, and as a tangent to the circle; and for the hard woods, tools of from seventy to ninety degrees upon the edge, applied as a radius, and parallel with the fibres, if so required. The tools last described answer very properly for the dense woods, in which the fibres are close and well united; but applied to the softer kinds, in which the filaments are more tender and less firmly joined, the hard-wood tools produce rough, torn, and unfinished surfaces.

In general the weight or specific gravity of the woods may be taken as a sure criterion of their hardness; for instance, the hard lignum-vitæ, box-wood, iron-wood, and others, are mostly so heavy as to sink in water; whereas the soft firs, poplar, willow, &c., do not, on the average, exceed half the weight of water, and others are of intermediate kind*.

The density or weight of many of the woods may be materially increased by their mechanical compression, which may be carried to the extent of fully one third or fourth of their bulk, and the weight and hardness obtain a corresponding increase. This has been practised for the compression of tree-nails for ships, by driving the pins through a metal ring smaller than themselves directly into the hole in the ship's side †; at other times, (for railway purposes,) the woods have been passed through rollers, but this practice has been discontinued, as it is found to spread the fibres laterally, and to tear them asunder ‡; an injury that does not occur when they are forced through a ring, which condenses the wood at all parts alike without any disturbance of its fibrous structure §, even when tested by the

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* The most dense wood I have met with is in Mr. Fincham's collection; it is the Iron Bark wood from New South Wales: in appearance it resembles a close hard mahogany, but more brown than red; its specific gravity is 1·426, and its strength, (compared with English oak, taken as usual at 1,000,) is 1557. On the other hand the lightest of the *true* woods is probably the *Cortiça*, or the *Anona palustris*, from Brazil, in Mr. Mier's collection; the specific gravity of this is only 0·206, (whereas that of cork is 0·240,) it has only one-seventh the weight of the Iron Bark wood. The *Cortiça* resembles ash in colour and grain, except that it is paler, finer, and much softer; it is used by the natives for wooden shoes, &c.

The *Pita* wood, that of the *Fourcroya gigantea*, of the Brazils, an *endogen* almost like pith, (used by the fishermen of Rio de Janeiro, as a slow match, for lighting cigars, &c.; also like cork for lining the drawers of cabinets for insects,) and the rice paper plant of India and China, which is still lighter and more pithy, can hardly be taken into comparison.

† Mr. Annersley's Patent, 1821, for building vessels of planks only, without ribs.

‡ Dublin and Kingston railway.

§ The mode at present practised by the Messrs. Ransome of Ipswich, (under their patent,) is to drive the pieces of oak into an iron ring by means of a screw press, and to expose them within the ring to a temperature of about 180° for twelve or sixteen hours before forcing them out again.

The tree-nails may be thus compressed into two-thirds their original size, and they recover three-fourths of the compression on being wetted; they are used for microscope; after compression the wood is so much harder, that it cuts very differently, and the pieces almost ring when they are struck together; fir may be thus compressed into a substance as close as pitch-pine.

In many of the more dense woods, we also find an abundance of gum or resin, which fills up many of those spaces that would be otherwise void: the gum not only makes the wood so much the heavier, but at the same time it appears to act in a mechanical manner, to mingle with the fibres as a cement, and to unite them into a stronger mass; for example, it is the turpentine that gives to the outer surface of each annual ring of the red and yellow deals, the hard horny character, and increases the elasticity*.

Those woods which are the more completely impregnated with resin, gum, or oil, are in general also the more durable, as they are better defended from the attacks of moisture and insects.

Timbers alternately exposed to wet and dry, are thought by Tredgold and others, to suffer from losing each time a certain portion of their soluble parts; if so, those which are naturally impregnated with substances insoluble in water, may in consequence, give out little or none of their component parts in the change from wet to dry, and on that account the better resist decay: this has been artificially imitated by forcing oil, tar, &c., through the pores of the wood from the one extremity†.

Many of the woods are very durable when constantly wet; the generality are so when always dry, although but few are suited to withstand the continual change from one to the other state; but these particulars, and many points of information respecting timber-woods that concern the general practice of building, or naval architecture, such as their specific gravities, relative strengths, resistances to bending and compression, &c. &c., are treated of in Tredgold's Elements of Carpentry, at considerable length‡.

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railway purposes, but appear equally desirable for ship-building, in which the treenails fulfil an important office, and in either case their after-expansion fixes them most securely.—*See* Minutes Inst. Civ. Eng. 1841, p. 83-7.

* *See* the treatment of the Firs in Norway, article FIRS, in Catalogue.

† The durability of *pitch* pine, when "wet and dry," is however questioned.

‡ The work contains a variety of the most useful tables: the reader will likewise find a set of tables of similar experiments on American timbers, by Lieut. Denison, Royal Engineers, F.R.S., &c., in the Trans. Inst. Civ. Eng., vol. ii. p. 15,

SECT. II.—ELASTIC AND NON-ELASTIC WOODS.

The most elastic woods are those, in which the annual or longitudinal fibres are the straightest, and the least interwoven with the medullary rays, and which are the least interrupted by the presence of knots; such are also the most easily rent, and the plainest in figure, as the lance-wood, hickory, ash, &c.; whereas others, in which the fibres are more crossed and interlaced, are considerably tougher and more rigid; they are also less disposed to split in a straight or economical manner, as oak, beech, mahogany, &c., which, although moderately elastic, do not bend with the facility of those before named.

Fishing-rods, unless made of bamboo, have generally ash for the lower joint, hickory for the two middle pieces, and a strip cut out of a bamboo of three or four inches diameter as the top joint. Archery bows are another example of elastic works; the "single-piece bow" is made of one rod of hickory, lancewood, or yew-tree, which last, if perfectly free from knots, is considered the most suitable wood: the "back or union bow" is made of two or sometimes three pieces glued together. The *back piece*, or that furthest from the string, is of rectangular section, and always of lancewood or hickory; the *belly*, which is nearly of semicircular section, is made of any hard wood that can be obtained straight and clean, as ruby-wood, rose-wood, greenheart, king-wood, snake-wood, and several others: it is in a great measure a matter of taste, as the elasticity is principally due to the back piece; the palmyra is also used for bows*.

The elasticity, or rather the flexibility of the woods, is greatly increased for the time, when they are heated by steaming or boiling, &c.; the process is continually employed for bending the

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and also two other sets of experiments on Indian timber woods, by Captain H. C. Baker, late of the Bengal Artillery, superintendent of the half-wrought timber-yard, Calcutta, at pp. 123 and 230 of the Gleanings of Science, published at Calcutta, 1829.

* The union bow is considered to be "softer," that is more agreeably elastic, than the single-piece bow, even when the two require the same weight to draw them to the length of the arrow. In the act of bending the bow, the back is put into tension, and the inner piece into a state of compression, and each wood is then employed in its most suitable manner. Sometimes the union bow is imitated by one solid piece of straight cocoa-wood, (of the West Indies, not that of the *cocoa-nut palm*,) in which case the tough fibrous sap is used for the back, and in its nature sufficiently resembles the lance-wood more generally used.

oak and other timbers for ship-building, the lance-wood shafts for carriages, the staves of casks, and various other works.

The woods are steamed in suitable vessels, and are screwed or wedged, at short intervals throughout their length, in contact with rigid patterns or moulds, and whilst under this restraint they are allowed to become perfectly cold; the pieces are then released. These bent works suffer very little departure from the forms thus given, and they possess the great advantage of the grain being parallel with the curve, which adds materially to their strength, saves much cost of material and time in the preparation, and gives, in fact, a new character to the timber.

The inner and outer plankings of ships, &c. are steamed or boiled before they are applied; they are brought into contact with the ribs by temporary screw-bolts, which are ultimately replaced by the copper bolts inserted through the three thicknesses and rivetted: or they are secured by oak or locust tree-nails, which are caulked at each end*.

Boiling and steaming are likewise employed for softening the woods, to facilitate the cutting as well as bending them †.

When the two sets of fibres meet in confused angular directions, they produce the tough cross-grained woods, such as lignum-vitæ, elm, &c., and, like the diagonal braces in carpentry and shipping, they deprive the mass of elasticity, and dispose it rather to break than to bend, especially when the pieces are thin, and the fibres crop out on both sides of the same; the confusion of the fibres is, at the same time, a fertile source of beauty of appearance in most woods.

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* See the description of Mr. William Hookey's apparatus for bending ships' timbers, rewarded by the Society of Arts in their Trans., vol. 32, p. 91.

Preference is now given to the "Steam Kiln" over the "Water Kiln," and the time allowed is one hour for each inch of the thickness of the timber; it loses much extractive matter in the process, which is never attempted a second time, as the wood then becomes brittle.

Colonel G. A. Lloyd devised an ingenious and economical mode of bending the timbers to constitute the ribs of a teak-bridge which he built in the Mauritius. Each rib was about 180 ft. long, and of 8 ft. rise, and consisted of five thicknesses of wood of various lengths and widths. The wood had been cut down about a month; it was well steamed and brought into contact with a strong mould, by means of an iron chain attached to a hook at the one extremity of the mould and passed under a roller fixed at the other; the chain was drawn tight by a powerful capstan. Whilst under restraint the neighbouring pieces were pinned together by treenails, after which a further portion of the rib was proceeded with: the seasoning of the timber was also effected by the process.

† Thus in Taylor's Patent Machinery for making casks, the blocks intended for the staves are cut out of white Canada oak to the size of thirty inches by five, and smaller. They are well steamed, and then sliced into pieces one-half or five-eighths inch thick, at the rate of 200 in each minute, by a process far more rapid and economical than sawing; the instrument being a revolving iron plate of 12 or 14 feet diameter, with two radial knives, arranged somewhat like the irons of an ordinary plane or spokeshave.

Elm is perhaps the toughest of the European woods; it is considered to bear the driving of bolts and nails better than any other, and it is on this account, and also for its great durability under water, constantly employed for the keels of ships, for boat-building, and a variety of works requiring great strength and exposure to wet.

A similar rigidity is also found to exist in the crooked and knotted limbs of trees from the confusion amongst the fibres, and such gnarled pieces of timber, especially those of oak, were in former days particularly valued for the knees of ships: of later years they have been in a great measure superseded by iron knees, which can be more accurately and effectively moulded at the forge to suit their respective places, and they cause a very great saving in the available room of the vessel.

The lignum-vitæ is a most peculiar wood, as its fibres seem arranged in moderately thick layers, crossing each other obliquely, often at as great an angle as thirty degrees with the axis of the tree; when the wood is split, it almost appears as if the one layer of annual fibres grew after the manner of an ordinary screw, and the succeeding layer wound the other way so as to cross them like a left-hand screw. The interlacement of the fibres in lignum-vitæ is so decided and rigid, although irregular, that it exceeds all other woods in resistance to splitting, which cannot be effected with economy; the wood is consequently always prepared with the saw. It is used for works that have to sustain great pressure and rough usage, several examples of which are given under the head Lignum-vitæ, in the Catalogue already referred to.

CHAPTER IV.

ORNAMENTAL CHARACTERS OF WOODS.

SECT. I.—FIBRE OR GRAIN, KNOTS, ETC.

THE ornamental figure or grain of many of the woods, appears to depend as much or more upon the particular directions and mixings of the fibres, as upon their differences of colour. I will first consider the effect of the fibre, assisted only by the slight variation of tint, observable between the inner and outer surfaces of the annual layers, and the lighter or more silky character of the medullary rays.

If the tree consisted of a series of truly cylindrical rings, like the tubes of a telescope, the horizontal section would exhibit circles; the vertical, parallel straight lines; and the oblique section would present parts of ovals; but nature rarely works with such formality, and but few trees are either exactly circular or straight, and therefore although the three natural sections have a general disposition to the figures described, every little bend and twist in the tree disturbs the regularity of the fibres, and adds to the variety and ornament of the wood.

The horizontal section, or that parallel with the earth, only displays the annual rings and medullary rays, as in fig. 1, p. 14, and this division of the wood is principally employed by the turner, as it is particularly appropriate to his works, the strength and shrinking being alike at all parts of the circumference, in the blocks and slices cut out of the entire tree, and tolerably so in those works turned out of the quarterings or parts of the transverse pieces.

But as the cut is made intermediate between the horizontal line, and the one parallel with the axis, the figure gradually slides into that of the ordinary plank, magnified portions of which are shown in figs. 2 and 3: and these are almost invariably selected for carpentry, &c.

The oblique slices of the woods possess neither the uniformity of grain of the one, nor the strength of the other section, and it would be likewise a most wasteful method of cutting up the timber; it is therefore only resorted to for thin veneers, when some particular figure or arrangement of the fibres, has to be obtained for the purposes of ornamental cabinet-work.

The perpendicular cut through the heart of the tree is not only the hardest but the most diversified, because therein occur the greatest mixture and variety of the fibres, the first and the last of which, in point of age, are then presented in the same plank; but of course the density and diversity lessen as the board is cut further away from the axis. In general the radial cut is also more ornamental than the tangental, as in the former the medullary rays produce the principal effect, they are then displayed in broader masses, and are considered to contain the greater proportion of the colouring matter of the wood.

The section through the heart displays likewise the origin of most of the branches, which arise first as knots, in or near the central pith, and then work outwards in directions corresponding with the arms of the trees, some of which, as in the cypress and oak, grow out nearly horizontally, and others, as in the poplar, shoot up almost perpendicularly.

Those parts of wood described as curls, are the result of the confused filling in of the space between the forks, or the springings of the branches. Fig. 9 represents the section of a piece of yew-tree, which shows remarkably well the direction of the main stem A B, and the origin of the branch C, and likewise

Fig. 9.

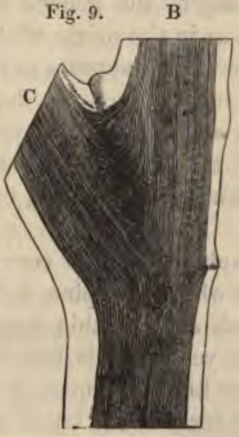
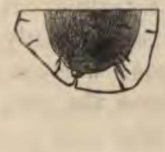


Fig. 10.



the formation of the curl between B and C; in many woods, the mahogany especially, the curls are particularly large, handsome and variegated, although distinctly similar as to origin. The fig. 10 is the end view of the stem at A.

It would appear as if the germs of the primary branches were set at a very early period of the growth of the central stem, and gave rise to the knots, many of which however fail to penetrate to the exterior so as to produce branches, but are covered over by the more vigorous deposition of the annual rings. All these knots and branches, act as so many disturbances and interruptions to the uniformity of the principal zones of fibres, which appear to divide to make way for the passage of the off-shoots, each of which possesses in its axis a filament of the pith, so that the branch resembles the general trunk in all respects except in bulk, and again from the principal branches smaller ones continually arise, ending at last in the most minute twigs, each of which is distinctly continuous with the central pith of the main stem, and fulfils its individual share in causing the diversity of figure in the wood.

The knots are commonly harder than the general substance, and that more particularly in the softer woods; the knots of the deals, for example, begin near the axis of the tree, and at first show the mingling of the general fibres with those of the knot, much the same as in the origin of the branch of the yew in fig. 9, but after a little while it appears as if the branch, from elongating so much more rapidly than the deposition of the annual rings upon the main stem, soon became entirely detached, and the future rings of the trunk were bent and turned slightly aside when they encountered the knot, but without uniting with it in any respect.

This may explain why the smooth cylindrical knots of the outer boards of white deal, pine, &c., so frequently drop out when exposed on both sides in thin boards; whereas the turpentine in the red and yellow deals may serve the part of a cement, and retain these kinds the more firmly.

The elliptical form of the knots in the plank, is mostly due to the oblique direction in which they are cut, and their hardness, (equal to that of many of the tropical hard woods,) to the close grouping of the annual rings and fibres of which they are themselves composed. These are compressed by the surrounding wood of the parent stem, at the time of deposition; whereas the principal layers of the axis of the tree are opposed alone by the loosened and yielding bark, and only obtain the ordinary density.

The knots of large trees are sometimes of considerable size. I have portions of one of those of the Norfolk Island pine, (*Araucaria excelsa*,) which attained the enormous size of about four feet long, and four to six inches diameter. In substance it is throughout compact and solid, of a semi-transparent hazel-brown, and it may be cut almost as well as ivory, and with the same tools, either into screws, or with eccentric or drilled work, &c.; it is an exceedingly appropriate material for ornamental turning*.

It is by some supposed that the root of a tree is divided into about as many parts or subdivisions as there are branches, and, that speaking generally, the roots spread around the same under ground, to about the same distance as the branches wave above; the little germs or knots from which they proceed being in the one case distributed throughout the length of the stem of the tree, and in the other crowded together in the shorter portion buried in the earth.

If this be true, we have a sufficient reason for the beautiful but gnarled character of the roots of trees when they are cut up for the arts; many a block of the root of the walnut-tree, thus made up of small knots and curls, that was intended for the stock of a fowling-piece, has been cut into veneers and arranged in angular pieces to form the circular picture of a table, and few of this natural kind will be found more beautiful. The roots of many trees also display very pretty markings; some are cut into veneers, and those of the olive-tree, and others, are much used on the Continent for making snuff-boxes.

The tops of the pollard trees, such as the red oak, elm, ash, &c., owe their beauty to a similar crowding together of the little germs, whence originate the numerous shoots which proceed from them after they have been lopped off. The burrs or excrescenses of the yew, and some other trees, appear to arise from a similar cause, apparently the unsuccessful attempts at the formation of branches from one individual spot, whence may arise those bosses or wens, which almost appear as the result of disease, and exhibit internally crowds of knots, with fibres surrounding them in the most fantastic shapes. Sometimes the burrs occur of immense size, so as to yield a large and thick slab of highly ornamental wood of most confused and irregular growth: such pieces are highly prized, and are cut into thin veneers to be used in cabinet-work.

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* I am indebted to Maj. Brown for my specimens of this knot, and the information concerning it; a part of a knot of the same species, with some of the surrounding wood, is in the model-room of the Admiralty, Somerset House.

It appears extremely clear likewise, that the beautiful East Indian wood, called both kiabooca and Amboyna, is, in like manner, the excrescence of a large timber tree. Its character is very similar to the burr of the yew, but its knots are commonly smaller, closer, and the grain or fibre is more silky. It has also been supposed to be the base of the cocoa-nut palm, a surmise that is hardly to be maintained although the latter may resemble it, as the kiabooca is imported alone from the East Indies, whereas the cocoa-nut palm is common and abundant both in the eastern and western hemispheres. (*See* KIABOOCA in the Catalogue*.)

The bird's-eye maple, shows in the finished work the peculiar appearance of small dots or ridges, or of little conical projections with a small hollow in the center, (to compare the trivial with the grand, like the summits of mountains, or the craters of volcanoes,) but without any resemblance to knots, the apparent cause of ornament in woods of somewhat similar character, as the burrs of the yew and kiabooca, and the Russian maple (or birch tree), &c.; this led me to seek a different cause for its formation.

On examination, I found the stem of the American bird's-eye maple, stripped of its bark, presented little pits or hollows of irregular form, some as if made with a conical punch, others ill-defined and flattened like the impression of a hob-nail; suspecting these indentations to arise from internal spines or points in the bark, a piece of the latter was stripped off from another block, when the surmise was verified by their appearance. The layers of the wood being moulded upon these spines, each of their fibres is abruptly curved at the respective places, and when cut through by the plane, they give, in the *tangental* slice, the appearance of projections, the same as in some rose-engine patterns, and the more recent medallic engravings, in which the closer approximation of the lines at their curvatures, causes those parts to be more black, (or shaded,) and produces upon the plane surfaces, the appearances of waves and ridges, or of the subject of the medal.

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* I have a beautiful specimen of a Burr, found occasionally upon the teak, which is fully equal in beauty to the Amboyna, but a smaller figure; I owe it to the kindness of Dr. Horsfield of the India-House.

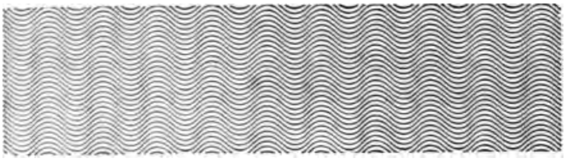
Mr. G. Loddiges considers the burrs may occur upon almost all *old* trees, and that they result from the last attempt of the plant to maintain life, by the reparation of any injury it may have received.

The short lines observed throughout the maple wood, between the dots or eyes, are the edges of the medullary rays, and the same piece of wood when examined upon the radial section, exhibits the ordinary silver grain, such as we find in the sycamore, (to which family the maple tree belongs,) with a very few of the dots, and those displayed in a far less ornamental manner.

The piece examined measured eight inches wide, and five and a half inches radially, and was apparently the produce of a tree of about sixteen inches diameter; the effect of the internal spines of the bark was observable entirely across the same, that is through each of the 130 zones of which it consisted. The curvature of the fibres was in general rather greater towards the center, which is to be accounted for by the successive annual depositions upon the bark, detracting in a small degree from the height or magnitude of the spines within the same, upon which the several deposits of wood were formed. Other woods also exhibit spines, which may be intended for the better attachment of the bark to the stem, but from their comparative minuteness, they produce no such effect on the wood as that which exists, I believe exclusively, in the bird's-eye maple.

This led me to conclude, that the figure in woods, which resembles the appearance of undulations, or the ripple mark on the sands, that is frequently observed in satin-wood and sycamore, less frequently in box-wood, and also in mahogany, ash, elm, &c., to be due to a similar cause, namely a serpentine or *guilloche* form in the grain : and on inspection, the fibres of all such pieces will be found to be wavy, (as in fig. 11,) on the face, at right angles to that on which the ripple is observed, if not on both faces. Those parts of the wood which happen to receive the light, appear the brightest, and form the ascending sides of the ripple, just as some of the medallic engravings appear in cameo or in intaglio, according to the direction in which the light falls upon them.

Fig. 11.



The woods possessing this wavy character, generally split with an undulating fracture, the ridges being commonly at right angles to the axis of the tree: but in a specimen of an Indian red wood, the native name of which is *Caliatour*, the ridges are inclined at a considerable angle, presenting a very peculiar appearance, seen as usual on the polished surface*.

In those woods which possess in abundance the *septæ* or *silver grain*, described by the botanist as the medullary plates or rays, (the representations of which as regards the beech tree are given in fig. 3, p. 14,) another source of ornament exists; namely, a peculiar damask or dappled effect, somewhat analogous to that artificially employed to produce damask linens, moreens, &c.; the pattern in which results from certain masses of the threads on the face of the cloth running lengthways, and other groups crossways. This effect is observable in a remarkable degree in the more central planks of oak, especially the light-coloured wood from Norway, and the neighbourhood of the Rhine, called wainscot and Dutch oak, &c., and also in many other woods, although in a less degree.

In the oak plank, the principal streaks or lines are the edges of the annual rings, which show, as usual, parallel lines more or less waved from the curvature of the tree, or the neighbouring knots and branches; and the damask pencillings, or broad curly veins and stripes, are caused by groups of the medullary rays or *septæ*, which undulate in layers from the margin to the center of the tree, and creep in betwixt the longitudinal fibres, above some of them and below others. The plane of the joiner, here and there, intersects portions of these groups, exactly on a level with their general surface, whereas their recent companions are partly removed in shavings, and the remainder dip beneath the edges of the annual rings, which break their continuity; this will be seen when the *septæ* are purposely cut through by the joiner's plane.

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* Dr. Royle favoured me with this curious specimen.

Upon inspecting the ends of the most showy pieces of wainscot oak and similar woods, it will be found that the surface of the board is only at a *small* angle with the lines of the medullary rays, so that *many* of the latter "crop out" upon the surface of the work: the medullary plates being seldom flat, their edges assume all kinds of curvatures and elongations from their oblique intersections. All these peculiarities of the grain have to be taken into account in cutting up woods, when the most showy character is a matter of consideration.

The same circumstances occur in a less degree in all the woods containing the silver grain, as the oriental plane-tree, or lace-wood, sycamore, beech, and many others*, but the figures become gradually smaller, until at last, in some of the foreign hard woods, they are only distinguishable on close inspection under the magnifier: when some of the latter, show lines very nearly parallel, and at right angles to the axis of the tree, as if they were chatters or utters arising from the vibration of the plane-iron. The medullary rays cause much of the beauty in all the showy woods, notwithstanding that they may be less defined than in those cited.

In many of the handsomely figured woods, some of the effects attributed to colour, would, as in damask, be more properly called those of light and shade, as they vary with the point of view selected for the moment. The end grain of mahogany, the surfaces of the table-cloth, and of the mother-of-pearl shell, are respectively of nearly uniform colour, but the figures of the wood and the damask, arise from the various ways in which they reflect the light.

Had the fibres of all these substances been arranged with the uniformity and exactitude of a piece of plain cloth, they would have shown an even uninterrupted colour, but fortunately for the beautiful and picturesque such is not the case; most fibres are arranged by nature in irregular curved lines, and therefore almost every intersection through them, by the hand of man, partially removes some and exposes others, with boundless variety of figure.

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* The *Cuticaem branco*, from Carvalho da Terra, Brazils, and *Cuticaem vermo*, brought over by Mr. Morney, (Admiralty Museum,) show the silver grain very prettily; the first in peculiar straight radial stripes, the other in small close patches. The *Rewa-rewa* (*Knightia excelsa*), from New Zealand, is of similar kind; each would be found handsome light-coloured furniture woods.

If further proof were wanted, that it is only the irregular arrangement that causes the damask or variegated effect, I might observe that the plain and uniform silk, when passed in two thicknesses face to face, between smooth rollers, comes out with the watered pattern; the respective fibres mutually emboss each other, and with the loss of their former regular character they cease to reflect the uniform tint*.

To so boundless an extent do the interferences of tints, fibres, curls, knots, &c., exist, that the cabinet-maker scarcely seeks to match any pieces of ornamental wood for the object he may be constructing. He covers the nest of drawers, or the table, with the neighbouring veneers from the same block, the proximity of the sections causing but a gradual and unobserved difference in the respective portions; as it would be in vain to attempt to find two different pieces of handsomely figured wood exactly alike.

SECT. II.—VARIATIONS OF COLOUR.

The figures of the woods depend also upon the colour as well as on the fibre; in some the tint is nearly uniform, but others partake of several shades of the same hue, or of two or three different colours, when a still greater change in their appearance results.

In the horizontal sections of such woods, the stripes wind partly round the center as if the tree had clothed itself at different parts with coats of varied colours with something like caprice: tulip-wood, king-wood, zebra-wood, rose-wood, and many others, show this very distinctly; and in the ordinary plank these markings get drawn out into stripes, bands and patches, and show mottled, dappled, or wavy figures of the most beautiful or grotesque characters, upon which it would be needless to enlarge, as a glance at the display of the upholsterer will convey more information than any description, even when assisted by coloured figures*.

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* The brilliant prismatic colours of the pearl are attributed to the decomposition and reflection of the light by the numerous minute grooves or striæ, a more vivid effect of the same general kind.

A beautiful artificial example of the same description was produced by Sir John Barton, then comptroller of the Royal Mint; he engraved with the diamond, the surfaces of hard steel dies in lines as fine as 2000 in the inch, arranged in hexagons, &c. The gold buttons struck from these dies display the brilliant play of iridescent colours of the originals.

Those woods which are variegated both in grain and colour, such as Amboyna, king-wood, some mahogany, maple, partridge, rose-wood, satin-wood, snake-wood, tulip-wood, zebra-wood, &c. &c.; are more generally employed for objects with smooth surfaces, such as cabinet-work, vases, and turned ornaments, as the beauties of their colours and figures are thereby the best displayed. Every little detail in the object causes a diversion in the forms of the stripes and marks existing in the wood: these terminate abruptly round the mouldings which have sharp edges, and upon the flowing lines they are undulated with infinite variety into curves of all kinds, which often terminate in fringes from the accidental intersections of the stripes in the woods.

The elegant works in marquetry, in which the effect of flowers, ornamental devices, or pictures, is attempted by the combination of pieces of naturally coloured woods, are invariably applied to plain surfaces. In the same manner the beautifully tesselated wood floors, abundant in the buildings of one or two centuries back, which exhibit geometrical combinations of the various ornamental woods, (an art that has been recently pursued in miniature by the Tunbridge turners in their Mosaic works;) are other instances, that in such cases the plain smooth surface is the most appropriate to display the effect and variety of the colours, for such of the last works as are turned into mouldings, fail to give us the same pleasure.

Even-tinted woods are best suited to the work of the eccentric chuck, the revolving cutters, and other instruments to be explained; in which works, the *carving* is the principal source of ornament: the variation of the wood, in grain or colour, when it occurs, together with the cutting of the surface, is rather a source of confusion than otherwise, and prevents the effect either of the material, or of the work executed upon it, from being thoroughly appreciated.

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* Attempts have been made to stain some of our European woods during their growth, by inserting certain portions of their roots in vessels filled with colouring matters, but I am not aware with what success. It is not however to be expected, that such a mode would be either so effective or permanent, as that produced by the natural absorption during the entire period of the life of the plant, an experiment of too lengthened and speculative a character to be readily undertaken.

The transverse section, or end grain of the plain woods, is the most proper for eccentric turning, as all the fibres are then under the same circumstances; many of the woods will not admit, the plankway of the grain, of being worked with such patterns: and of all the woods the black Botany Bay wood, or the black African wood, by which name soever it may be called, is certainly by far the best for eccentric turning; next to it, and nearly its equal, is the cocoa-wood, (from the West Indies, not the cocoa-nut palm); several others may also be used, but the choice should always fall on those which are of *uniform* tint, and sufficiently hard and close to receive a polished surface from the *tool*, as such works admit of no subsequent improvement.

Contrary to the rule that holds good with regard to most substances, the colours of the generality of the woods become considerably *darker* by exposure to the light; tulip wood is, I believe, the only one that fades. The tints are also rendered considerably darker from being covered with oil or lacker, and although the latter checks their assuming the deepest hues, it does not entirely prevent the subsequent change. The yellow colour of the ordinary varnishes greatly interferes also with the tints of the light woods, for which the whitest possible kinds should be selected*. When it is required to give to wood that has been recently worked, the appearance of that which has become dark from age, as in repairing any accident in furniture, &c., it is generally effected by washing it with lime-water; or in extreme cases, by laying on the lime as water-colour, and allowing it to remain for a few minutes, hours, or days, according to circumstances. In many cases the colours of the woods are heightened or modified, by applying colouring matters either before, or with the varnish; and in this manner handsome birch-wood is sometimes converted into fictitious mahogany, by a process of colouring rather than dyeing, that often escapes detection.

The bog-oak is by some considered to assume its black colour from the small portion of iron contained in the bog or moss, combining with the gallic acid of the wood, and forming a natural stain, similar to writing ink. Much of the oak timber of the Royal George that was accidentally sunk at Spithead, in 1782, and which has been recently extricated by Col. Pasley's submarine explosions, is only blackened on its outer surface, and the most so in the neighbourhood of the pieces of *iron;* the inside of the thick pieces, is in general of nearly its original colour and soundness. Some specimens of cam-wood* have maintained their original beautiful red and orange colours, although the inscription says that they were "washed on shore at Kay Haven, in October 1840, with part of the wreck of the Royal Tar, lost near the Needles twenty years ago, when all the crew perished."

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* Specimens of woods for cabinets should be left in their natural state, or at most they should be polished by friction only; or if varnished, then upon the one side alone. Their colours are best preserved when they are excluded from the light, either in drawers or in glass cases, covered with some thick blind.

The recent remarks on colour equally apply to the works of statuary, carving and modelling generally: the materials for which are either selected of one uniform colour, or they are so painted. Then only is the full effect of the artist's skill apparent at the first glance; otherwise it frequently happens either that the eye is offended by the interference of the accidental markings, or fails to appreciate the general form or design, without a degree of investigation and effort, that detracts from the gratification which would be otherwise *immediately* experienced on looking at such carved works.

This leads me to advert to modes sometimes practised to produce the effect of carving: thus, in the Manuel du Tourneur†, a minute description will be found of the mode of making embossed wooden boxes, which are pressed into metallic moulds, engraved with any particular device. The wood is first turned to the appropriate shape, and then forced by a powerful screw-press into the heated mould, (which is made just hot enough to avoid materially discolouring the wood,) it is allowed to remain in that situation until it is cold; this method however only applies to subjects in small relief, and is principally employed on knotty pieces of box-wood and olive wood of irregular curly grain.

The following may be used for bolder designs, more resembling ordinary carving: the fine sawdust of any particular wood it is required to imitate, is mixed with glue or other cementitious matter, and squeezed into metallic moulds, but in the latter case the peculiar characteristic of the wood, namely its fibrous structure, is entirely lost, and the eye only views the work as a piece of cement or composition, which might be more efficiently produced from other materials, and afterwards coloured.

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* Received from the hands of H. Hardman, Esq.

† Second Edition, vol. ii., pp. 441-451.

Each of these processes partakes rather of the proceeding of the manufacturer than of the amateur; extensive preparations, such as very exact moulds consisting of several parts, and a powerful press, &c., are required,* and the results are so proverbially alike, from being "formed in the same mould," that they lose the interest attached to original works, in the same manner that engravings are less valued than the original paintings from which they are copied.

Another method of working in wood may be noticed, which is at any rate free from the objections recently advanced: I will transcribe its brief description†.

"Raised figures on wood, such as are employed in picture frames and other articles of ornamental cabinet work, are produced by means of carving, or by casting the pattern in Paris plaster or other composition, and cementing or otherwise fixing it on the surface of the wood. The former mode is expensive, the latter is inapplicable on many occasions.

"The invention of Mr. Straker may be used either by itself or in aid of carving; and depends on the fact, that if a depression be made by a blunt instrument on the surface of wood, such depressed part will again rise to its original level by subsequent immersion in water.

"The wood to be ornamented having first been worked out to its proposed shape, is in a state to receive the drawing of the pattern; this being put in, a blunt steel tool, or burnisher, or die, is to be applied successively to all those parts of the pattern intended to be in relief, and at the same time is to be driven very cautiously, without breaking the grain of the wood, till the depth of the depression is equal to the subsequent prominence of the figures. The ground is then to be reduced by planing or filing to the level of the depressed part; after which, the piece of wood being placed in water, either hot or cold, the parts previously depressed will rise to their former height, and will thus form an embossed pattern, which may be finished by the usual operations of carving.

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* See the Section on Tortoiseshell.

† Trans. Soc. of Arts, vol. xlii., p. 52.

CHAPTER V.

PERMANENCE OF FORM, AND COMBINATION OF THE WOODS.

SECT. I.—SHRINKING AND WARPING.

THE permanence of the form and dimensions of the woods requires particular consideration, even more than their comparative degrees of ornament, especially as concerns those works which consist of various parts, for unless they are combined with a due regard to the strength of the pieces in different directions, and to the manner and degree to which they are likely to be influenced by the atmosphere, the works will split or warp, and may probably be rendered entirely useless.

The piece of dried wood is materially smaller than in its first or wet state, and as it is at all times liable to re-absorb moisture from a damp atmosphere, and to give it off to a dry one, even after having been thoroughly seasoned, the alterations of size again occur, although in a less degree.

The change in the direction of the *length* of the fibres is in general very inconsiderable *. It is so little in those of straight grain, that a rod split out of clean fir or deal is sometimes employed as the pendulum of a clock, for which use it is only inferior to some of the compensating pendulums: whereas a piece of the same wood taken diametrically out of the center of a tree, or the crossway of the grain, forms an excellent hygrometer, and indicates by its change of length the degree of moisture of the atmosphere. The important difference in the general circumstances of the woods, in the two directions of the grain, I propose to notice, first as regards the purposes of turning, and afterwards those of joinery work, which will render it necessary to revert to the wood in its original, or unseasoned state.

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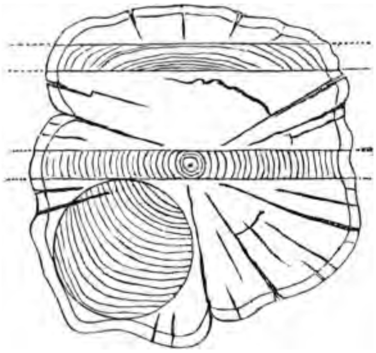
* Good box-wood and lance-wood are approved by the Tithe Commissioners for the verified scales to be employed in laying down the plans for the recent Parliamentary survey, as being next in accuracy to those of metal; whereas those of ivory are entirely rejected by them, owing to their material *variation in length* under hygrometrical influence. See their printed papers.

Mr. Fincham says he has found a remarkable variation in the New Zealand pine the Kourie or Cowrie, corrupted into Cowdie, which expands so much as to cause the strips constituting the inside mouldings of ships to expand and buckle, probably from the comparative moisture of our atmosphere: and Colonel Lloyd says he found the teak timbers used by him in constructing a large room in the Mauritius, to have shrunk three quarters of an inch in thirty-eight feet, although this wood is by many considered to shrink sideways least of all others.

The turner commonly employs the transverse section of the wood, and we may suppose the annual rings then exhibited, to consist of circular rows of fibres of uniform size, each of which, for the sake of explanation, I will suppose to be the one hundredth of an inch in diameter.

When the log of green wood is exposed to a dry atmosphere, the outer fibres contract both at the sides and ends, whereas those within, are in a measure shielded from its immediate effect, and nearly retain their original dimensions. Supposing each of the outside fibres to be reduced to the one hundred and tenth, or the one hundred and twentieth of an inch, as the external series can no longer fill out the original extent of the annual ring, the same as they did before they were dried; they divide, not singly, but into groups, as the unyielding center, or the incompressible mass within the arch, causes the parts of which the latter is composed to separate, and the divisions occur in preference at the natural indentations of the margin, which appear to indicate the places where the splits are likely to commence.

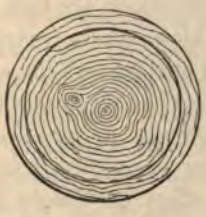
Fig. 12.



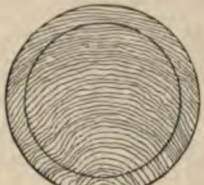
The ends being the most exposed to the air are the first attacked, and there the splits are principally radial, with occasional diversions concentric with the layers of fibres, as in fig. 12, and on the side of the log, the splits become gradually extended in the direction of its length. The air penetrates the cracks, and extends both cause and effect, and an exposure of a few weeks, days, or even one day, to a hot dry atmosphere, will sometimes spoil the entire log, and the more rapidly the harder the wood, from its less general penetrability to the air. This effect is in part stayed by covering the ends of the wood with grease, wax, glue, paper, &c., to defend them, but the best plan is to transfer the pieces very gradually from the one atmosphere to the other, to expose them equally to the air at all parts, and to avoid the influence of the sun, hot drying winds, &c.

The horizontal slice or block of the entire tree, is the most proper for the works of the lathe, as it is presented by nature the most nearly prepared to our hand, and its appearance, strength, grain, shrinking, &c., are the most uniform. The annual rings, if any be visible, are, as in fig. 13, concentric with the object, the fibres around the circumference are alike, and the contraction occurs without causing any sensible departure from the circular form. Although thin transverse slices are necessarily weak from the inconsiderable length of the fibres of which they are composed, (equal only in length to the *thickness* of the plate,) they are strengthened in the generality of turned works by the margin, such as we find in the rim of a snuff-box, &c., which supports the bottom like the hoop of a drum or tambarine.

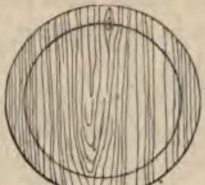
Figs. 13.



14.



15.



The entire circular section is therefore most appropriate for turning, next to it the quartering (fig. 14,) should be chosen, but its appearance is less favourable; and a worse effect happens as the shrinking causes a sensible departure from the circle, the contraction being invariably greater upon the circular arcs of fibres, than the radial lines or medullary rays. If such works be turned before the materials are thoroughly prepared, they will become considerably oval; so much so, that a manufacturer who is in the habit of working up large quantities of pear-tree, informs me that hollowed pieces rough turned to the circle, alter so much and so unequally in the drying, that works of three inches will sometimes shrink half an inch more on the one diameter than the other, and become quite oval; it is therefore necessary to leave them half an inch larger than the intended size. Even in woods that were comparatively dry, a small difference may in general be detected by the callipers, when they have been turned some time, from their unequal contraction.

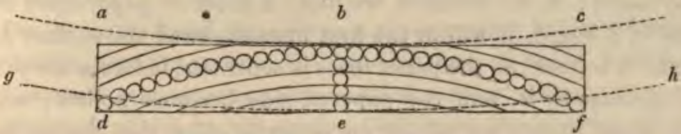
In pieces cut lengthways, such as fig. 15, circumstances are still less favourable; there being no perceptible contraction in the length of the fibres, the whole of the shrinking takes place laterally, at right angles to them, and the work becomes oval to the full extent of the contraction that occurs in the fibres.

The plank-wood is almost solely employed for large discs which would be too weak if cut out transversely; and in some cases for objects made from those ornamental woods which are best displayed in that section, as the tulip, rose, king, zebra, partridge, and satin woods. Specimens of oak from ancient buildings, are sometimes thus worked, but in all such cases the wood should be exceedingly well dried beforehand; otherwise in addition to the inconvenience arising from the greater departure from the circle, the pieces will warp and twist, an effect that more generally concerns the joiner's art, and to the consideration of which we will now proceed.

When the green wood is cut up into planks, boards, and veneers, the splitting which occurs in the transverse section is less to be feared than distortion or warping, from the unequal contraction of the fibres. The thick planks are partially stayed from splitting and opening, by cleets nailed upon each end; the boards are left to themselves, and the veneers are protected from accidental violence by slips of cloth glued upon each end.

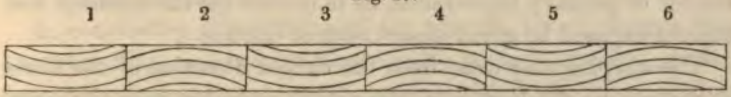
One plank only in each tree can be exactly diametrical, the others are parallel therewith, and, as shown in fig. 12, the two sides of all but the central board, are under different circumstances as regards the arrangement of the fibres, and they contract differently. It will be generally found that the boards exposed to similar conditions on both sides, become, from the simple effect of drying, convex on the side towards the center of the tree; this will be explained by a reference to the diagram, fig. 16, which shows that the longest continuous line of fibres is concentric with the axis of the tree. Thus let *a*, *b*, *c*, *d*, *e*, *f*, represent the section of a board, the line *b*, *e*, of which is supposed to contain five fibres, and the arc *d*, *b*, *f*, thirty: therefore supposing each fibre to shrink alike in general dimensions, the contraction on the arc, will be six times that upon the short radial line, and the new margin of the board will be the dotted line which proceeds from *g* to *h*, the departure of which from the original straight line will be five times as much at *d* as at *e*.

Fig. 16.



This is not imaginary, as it is in all cases borne out by observation, where the pieces are exposed to similar circumstances on both sides. When a true flat board is wanted, it is a common practice to saw the wide plank in two or four pieces, to change sides with them alternately, and glue them together again as in fig. 17, so that the pieces, 1, 3, 5, may present the sides towards the axis of the tree, and 2, 4, 6, those towards its circumference; when the curvature from shrinking will become a serpentine line consisting of six arcs, instead of one continuous circular sweep.

Fig. 17.



When the opposite sides of a board are exposed to *unequal* conditions, the moisture will swell the fibres on the one side and make that convex, and in the opposite manner that exposed to the dry air or heat will contract and become concave; from these circumstances, when several pieces of wood are placed around the room or before the fire "*to air*," the sides should be continually changed, that both may have equal treatment, so as to lessen the tendency to curvature. To remedy the defect when it may have occurred, the joiner exposes the convex side to the fire, but it is obviously better to be sparing of these sudden changes.

Any unequal treatment of the two sides is almost sure to curl the board; if, for instance, we paste a sheet of paper upon one side of a board, it will in the first instance swell the surface and make it convex; as the paper dries it contracts, it forces the wood to accompany it, and the papered side becomes hollow; when two equal papers are pasted on opposite sides, this change does not generally occur. A similar effect is often observed when a veneer is glued on a piece of wood; hence it is usual to swell the surface on which the veneer is to be laid, by wetting it with a sponge dipped in thin size, so as to make it moderately round; in this case, the wetted surface of the board, and the glued surface of the veneer, are expanded nearly alike by the moisture, and in drying they also contract alike, so that the board recovers its true flat figure.

The woods are much less disposed to become curved in the direction of their *length*, than crossways; but another evil equally or more untractable is now met with, as the general figure of the board is more or less disposed to twist and warp, so that when it is laid upon a flat surface it touches only at the two diagonal corners, and is said to be "*in winding*." This error is the less experienced in the straight-grained pines and mahogany, which are therefore selected for works in which constancy of figure is a matter of primary importance, as in models for the foundry, and objects exposed to great vicissitudes of climate.

The warping may arise from the curved direction of the fibres in respect to the length of the plank, and also from the *spiral* direction in which many trees grow; in some, for example, the furrows of the bark are frequently twisted as much as fifteen or twenty degrees from the perpendicular, and sometimes even thirty and forty. The woods themselves when split through the center of the tree differ materially; they sometimes present a tolerably flat surface, at others they are much winding or twisted, a further corroboration of the "spiral growth;" we cannot be therefore much surprised that the planks cut out from such woods, should in a degree pursue the paths thus early impressed upon them.

Box-wood is often very much twisted in this manner. I have a block, the diameter of which is nine inches; its surface is split at five parts, with spiral grooves, at an angle of nearly thirty degrees with the axis; these make exactly *one complete revolution*, or one turn of a screw in the length of the piece, which is just three feet.

On the other hand, the *Alerce*, a pine growing in the island of Chiloe in South America, to the diameter of about four feet, whose wood resembles the cedar of Lebanon in colour, is so remarkably straight in the grain, that it is the custom of the country to *split* it into planks about eight feet long and seven inches wide, which are almost as true as if they were cut with the saw, although of course not quite so smooth.

To correct the errors of winding and curvature in length, the joiner in working upon rigid pieces, first planes off the higher points so as to produce the true form by reduction. But when the objects are long and thin, they are corrected by the hands, just as we should straighten a cane, or a walking stick, except that the one angle of the board is rested upon the bench or floor, the other is held in the hand, and the pressure is applied between them.

Broad thin pieces are sometimes warmed on both sides before the fire to lessen their rigidity; they are then fixed between two stout flat boards by means of several hand-screws, and allowed to remain until they are quite cold; this is just the reverse of the mode of bending timber for ship-building, &c., but applied in a less elaborate manner.

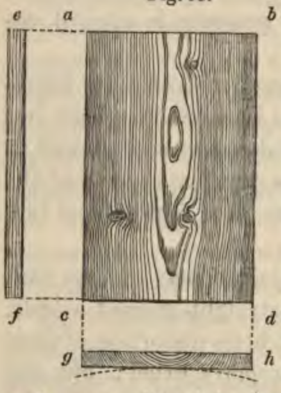
In concluding this division of the subject, I may observe that the shrinking and contracting of the straight-grained woods, especially deal and mahogany, cause but little distortion of their general shape after they have been properly dried; but the diversity of grain, a principal cause of beauty of figure in the ornamental woods, is at the same time a source of confusion in their shrinking, which being called on to pursue many paths, (which are parallel with the fibres, however tortuous,) gives rise to a greater disturbance from the original shape, or in extreme cases, even causes them to split where the contraction is restrained by the peculiarity of growth.

In the handsome furniture woods the economy of manufacture corrects this evil, as from their great value they are cut into very thin slices or veneers, and glued upon a stout fabric of straight-grained wood, commonly inferior mahogany, cedar, or deal, by which the opposite characters, of beauty and permanence, are combined at a moderate expense; these processes will be explained.

SECT. II.—COMBINING DIFFERENT PIECES OF WOOD.

In combining several pieces of wood for the works in carpentry and cabinet-making, the different circumstances of the plank as respects its length and width should be always borne in mind. Provision must be made that the shrinking and swelling are as little restrained as possible, otherwise the pieces may split and warp with an irresistible force; and the principal reliance for permanence or standing, should be placed on those pieces, (or lines of the work,) cut out the lengthway of the plank, which are, as explained, much less disposed to break or become crooked, than the crossway sections: these particulars will be more distinctly shown by one or two illustrations.

Fig. 18.



Let *a*, *b*, *c*, *d*, represent the flat surface of a board; *e*, *f*, the side of the same, and *g*, *h*, the end; no contraction will occur upon the line *e*, *f*, or the length, and in the general way, that line will remain pretty straight and rigid; but the whole of the shrinking will take place on *g*, *h*, the width, which is slender, flexible, and disposed to become curved from any unequal exposure to the air; the four marginal lines of *a*, *b*, *c*, *d*, are not likely to alter in respect to each other, but they will remain mutually parallel and square, if originally so formed.

A dove-tailed box consists of six such pieces, the four *sides* of which, A, B, C, D, fig. 19, are interlaced at the angles by the dove-tails, so that the flexible lines, as *g*, *h*, on B, are connected with, and strengthened by, the strong lines, as *c*, *d* on A, and so on: the whole collectively form a very rigid frame, the more especially when the bottom piece is fixed to the sides by glue or screws, as it entirely removes from them the small power of racking upon the four angles, (by a motion like that of the parallel rule,) which might happen if the dove-tails, shown on a larger scale in fig. 20, were loosely fitted.

Fig. 19.

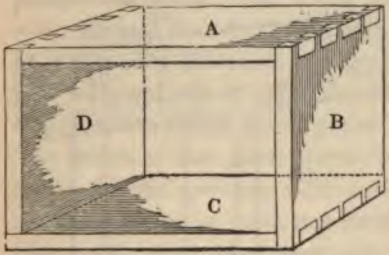
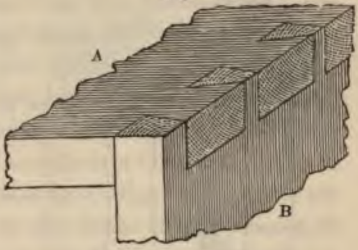


Fig. 20.



When the grain of the four sides, A, B, C, D, runs in the *same* direction, or parallel with the edges of the box or drawer, as shown by the shade lines on A and B, and the pieces are equally wet or dry, they will contract or expand equally, and without any mischief or derangement happening to the work; to ensure this condition, the four sides are usually cut out of the same plank. But if the pieces had the grain in different directions, as C and D, and the two were nailed together, D, would entirely prevent the contraction or expansion of C, and the latter would probably be split or cast by the restraint. When admissible, it is therefore usual to avoid *fixing* together those pieces, in which the grain runs respectively lengthways and crossways, especially where apprehension exists of the occurrence of swelling or shrinking.

A wide board, fig. 21, composed of the slips A, B, C, D, E, (reversed as in diagram, fig. 17, page 51,) is rendered still more permanent, and very much stronger, when its ends are confined by two clamps, such as G, H, (one only seen;) the shade lines represent the direction of the grain. The group of pieces, A to E, contract in width upon the line A, E, and upon it they are also flexible, whereas the clamp G, H, is strong and incapable of contraction in that direction, and therefore unless the wood is thoroughly dry the two parts should be connected in a manner that will allow for the alteration of the one alone. This is effected by the tongue and groove fitting as represented; the end piece, G, H, is sometimes only fastened by a little glue in the center of its length, but in cabinet-work, where the seasoning of the wood is generally better attended to, it is glued throughout.

If the clamp G, H, were fixed by tenons, (one of which, *i*, *j*, is shown detached in fig. 22,) the contraction of the part of the board between the tenons might cause it to split, the distance between the mortices in G, H, being unalterable; or the swelling of the board might cause it to bulge, and become rounding; or the entire frame would twist and warp, as the expansion of the center, might be more powerful than the resistance to change in the clamp, and force it to bend.

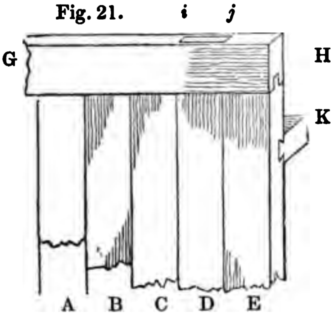


Fig. 21.

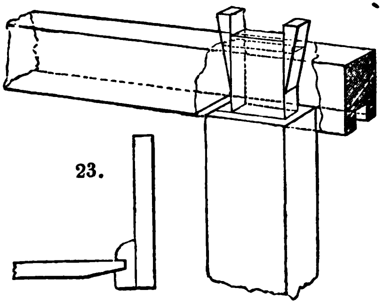


Fig. 22.

23.

It is therefore obvious that if any question exist as to the entire dryness of the wood, the use of the clamps is hazardous; although in their absence, the shrinking might tear away the wood from the plain glue joint, even if it extended entirely across, without causing any further mischief, but more generally it would split the solid board.

Another mode of clamping is represented at K; it is there placed edgeways, and attached by an undercut or dove-tailed groove, slightly taper in its length, and is fixed by a little glue at the larger end, which holds the two in firm contact: each of these modes is frequently employed for the large drawing boards required by architects and engineers for the drawings, made with squares and instruments.

From a similar motive, the thin bottom of a drawer is grooved into the two sides and front, and only fixed to the back of the drawer by a few small screws or brads, so that it may swell or shrink without splitting, which might result were it confined all around its margin. It is more usual, however, to glue thin slips along the *sides* of large drawers, as in fig. 23, which strengthen the sides, and being grooved to receive the bottom, allow it to shrink without interfering either with the front or back of the drawer.

In an ordinary door with two or more panels, all the marginal pieces run lengthways of the grain: the two sides, called the *stiles*, extend the whole height, and receive the transverse pieces or *rails*, now morticed through the stiles, and wedged tight, but without risk of splitting, on account of their small width; each panel is fitted into a groove within four edges of the frame. The width of the panel should be a trifle less than the extreme width of the grooves, and even the mouldings, when they are not worked in the solid, are fixed to the frame alone, and not to the panel, that they may not interfere with its alterations; therefore in every direction, we have the frame-work in its strongest and most permanent position as to grain, and the panel is unrestrained from alteration in width if so disposed.

This system of combination is carried to a great extent in the tops of mahogany billiard tables, which consist of numerous panels about 8 inches square, the frames of which are 3½ in. wide and 1½ in. thick; the panels are ploughed and tongued so as to be level on the upper side, and from their small size the individual contraction of the separate pieces is insignificant, and consequently the general figure of the table is comparatively certain. Of late years, I am told*, that slate, a material uninfluenced by the atmosphere, has been almost exclusively used; the top of a full-sized table, of 12 by 6 feet, consists of four slabs one inch thick, ground on their lower, and planed by machinery on their upper surfaces: the iron tables are almost abandoned for several reasons. Large thin slates are likewise used by engineers and others for drawing upon, and also in carpentry for the panels of superior doors.

SECT. III.—ON GLUEING VARIOUS WORKS IN WOOD.

GLUE is the cement used for joining different pieces of wood; it is a common jelly, made from the scraps that are pared off the hides of animals before they are subjected to the tan-pit for conversion into leather. The inferior kinds of glue are often contaminated with a considerable portion of the lime used for removing the hair from the skins, but the better sorts are transparent, especially the thin cakes of the Salisbury glue, which are of a clear amber colour.

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* By Mr. Thurston, of Catherine-street.

In preparing the glue for use, it is most usually broken into small pieces, and soaked for about twelve hours in as much water as will cover it; it is then melted in a glue-kettle, which is a double vessel or water bath, the inner one for the glue, the outer for the water, in order that the temperature applied may never *exceed* that of boiling water. The glue is allowed at first to simmer gently for one or two hours, and if needful it is thinned by the addition of hot water, until it runs from the brush in a fine stream; it should be kept free from dust and dirt by a cover, in which a notch is made for the brush. Sometimes the glue is covered with water, and boiled without being soaked.

Glue is considered to act in a twofold manner, first by simple adhesion, and secondly by excluding the air, so as to bring into action the pressure of the atmosphere. The latter however alone, is an insufficient explanation, as the strength of a well-made glue joint is frequently greater than the known pressure of the atmosphere: indeed it often exceeds the strength of the solid wood, as the fracture does not at all times occur through the joint, and when it does, it almost invariably tears out some of the fibres of the wood: mahogany and deal are considered to hold the glue better than any other woods.

It is a great mistake to depend upon the quantity or thickness of the glue, as that joint holds the best in which the neighbouring pieces of wood are brought the most closely into contact; they should first be well wetted with the glue, and then pressed together in various ways to exclude as much of it as possible, as will be explained.

The works in turnery do not in general require much recourse to glue, as the parts are more usually connected by screws cut upon the edges of their materials themselves; but in those cases in which it is needful, the mode of proceeding is so completely similar to that practised in joinery works, that no separate instructions appear to be called for, especially as those parts in which it is required, as for example the Tunbridge ware, &c., partake of the nature of joinery work.

When glue is applied to the end grain of the wood, it is rapidly absorbed in the pores; it is therefore usual first to glue the end wood rather plentifully, and to allow it to soak in to fill the grain, and then to repeat the process until the usual quantity will remain upon the face of the work; but it never holds so well as upon the lengthway of the fibres.

In glueing the edges of two boards together, they are first planed very straight, true, and square; they are then carefully examined as to accuracy, and marked, to show which way they are intended to be placed. The one piece is fixed upright in the chops of the bench, the other is laid obliquely against it, and the glue-brush is then run along the angle formed between their edges, which are then placed in contact, and rubbed hard together lengthways, to force out as much of the glue as possible. When the joint begins to feel stiff under the hand, the two parts are brought into their intended position and left to dry; or as the bench cannot in general be spared so long, the work is cautiously removed from it, and rested in contact with a slip of wood placed against the wall, at a small inclination from the perpendicular. Two men are required in glueing the joints of long boards.

In glueing a thin slip of wood on the edge of a board, as for a moulding, it is rubbed down very close and firm, and if it show any disposition to spring up at the ends, it is retained by placing thereon heavy weights, which should remain until the work is cold: but it is a better plan to glue on a wide piece, and then to saw off the part exceeding that which is required.

Many works require screw-clamps and other contrivances, to retain the respective parts in contact whilst the glue is drying; in others the fittings by which the pieces are attached together, supply the needful pressure. For instance, in glueing the dove-tails of a box, or drawer, &c., such as fig. 19, page 55, the dove-tails, if properly fitted, hold the sides together in the requisite manner, and the following is the order of proceeding.

The dove-tail pins, on the end B, fig. 19, are first sparingly glued, that piece is then fixed in the chops of the bench glue upwards, and the side A, held horizontally, is driven down upon B by blows of a hammer, which are given upon a waste piece of wood, smooth upon its lower face, and placed over the dove-tail pins, which should a little exceed the thickness of the wood, so that when their superfluous length is finally planed off, they may make a good clean joint. When the pins of the dove-tails come flush with the face, the driving block is placed *beside* them to allow the pins to rise above the surface. The second end, D, is then glued the same as B, it is also fixed in the bench, and A is driven down upon it as before; this unites the three sides of the square. The other pins on the ends B and D are then glued, and the first side, A, is placed downwards on the bench, upon two slips of wood placed close under the dove-tails, that it may stand solid, and the remaining side, D, is driven down upon them to complete the connexion of the four sides.

The box is then measured with a square, to ascertain if it have accidentally become rhomboidal, or *out of square*, which should be immediately corrected by pressure in the direction of the longer diagonal; lastly, the superfluous glue is scraped off whilst it is still soft with a chisel, and a sponge dipped in the hot water of the glue-kettle is occasionally used, to remove the last portion of glue from the work.

The general method pursued in glueing the angles of the frame for a panel, is somewhat similar, although modified, to meet the different structure of the joints. The tenons are made quite parallel both ways, but the mortices are a little bevelled or made longer outside, to admit the small wedges by which the tenons are fastened: and the stiles are made somewhat longer than when finished, to prevent the mortices from being broken out in driving the wedges, which are often cut out of the waste pieces sawn off from the tenons in forming their *shoulders* or *haunches*. These details are seen in fig. 22, p. 56.

In glueing the frame for a single panel which is fitted into a groove, the whole of the frame is put together before commencing the glueing, and the stiles are knocked off one at a time, by which the misplacement of the pieces is avoided. The tenons are glued, and a little glue is thrust into the two mortices with a thin piece of wood; when the stiles have been driven down close, the joint is completed by the insertion of a wedge on each side of the tenon; their points are dipped in the glue, and they are driven in like nails, so as to fill out the mortices, after which the tenons cannot be withdrawn: sometimes the wedges are driven into saw-kerfs, previously made near the sides of the tenons; the other stile is then knocked off, glued, and fixed in the same manner. Occasionally all four tenons are glued at the same time, and the two stiles are pressed together by screw-clamps, stretching across the frame just within the tenons; the wedges are lastly driven in, before the removal of the clamps, and the door if square and true is left to dry.

In many other cases also, the respective pieces are pressed together by screws variously contrived; the boards employed to save the work from being disfigured by the screws are planed flat, and are warmed before the fire, to supply heat to keep the glue fluid until the work is screwed up, and the warmth afterwards assists in drying the glue: such heated boards are named *cauls*, and they are particularly needed in laying down large veneers, which process is thus accomplished.

The surfaces of the table or panel, and both sides of the veneer, are scratched over with a tool called a toothing-plane, which has a perpendicular iron full of small grooves, so that it always retains a notched or serrated edge; this makes the roughness on the respective pieces, called the *tooth* or *key*, for the hold of the glue. A caul of the size of the table is made ready; and several pairs of clamps, each consisting of two strong wooden bars, placed edgeways and planed a little convex or rounding on their inner edges, and connected at their extremities with iron screw bolts and nuts, are adjusted to the proper opening*; the table is warmed on its face, and the veneer and caul are both made very hot.

All being ready, the table is brushed over quickly with thin glue or size, the veneer is glued and laid on the table, then the hot caul, and lastly the clamping bars, which are screwed down as quickly as possible, at distances of three or four inches asunder, until they lie exactly flat. The slender veneer is thereby made to touch the table at every point, and almost the whole of the glue is squeezed out, as the heat of the caul is readily communicated through the thin veneer to the same, and retains it in a state of fluidity for the short space of time required for screwing down, when several active men are engaged in the process. The table is kept under restraint until entirely cold, generally for the whole night at least, and the drying is not considered complete under two or three days*.

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* If the clamps were straight, their pressure would be only exerted at the sides of the table, but being curved to the extent of an inch in three or four feet, their pressure is first exerted in the center, and gradually extends over their entire length, when they are so far strained as to make the rounded edge bear flat upon the table and caul respectively.

When the objects to be glued are curved, the cauls, or moulds, must be made of the counterpart curve, so as to fit them ; for example, in glueing the sounding board upon the body of the harp, which may be compared to the half of a cone, a trough, or caul, is used of a corresponding curvature, and furnished all along the edge with a series of screws to bring the work into the closest possible contact.

In glueing the veneers of maple, oak, and other woods upon curved mouldings, such as those for picture-frames, the cauls, or counterpart moulds, are made to fit the work exactly. The moulding is usually made in long pieces and polished, previously to being mitred or joined together to the sizes required.

In works that are curved in their length, as the circular fronts of drawers, and many of the foundry patterns that are worked to a long sweep, the pieces that receive the pressure of the screws used in fixing the work together "whilst it is under glue," are made in narrow slips, and pierced with a small hole at each end; they are then strung together like a necklace, but with two strings. This flexible caul can be used for all curves; the strings prevent the derangement of the pieces whilst they are being fixed, or their loss when they are not in use.

I have mentioned these cases to explain the general methods; and to urge the necessity for thin glue; of a proper degree of warmth to prevent it from being chilled; and a pressure that may cause the greatest possible exclusion of glue from the joint. But for the comparatively small purposes of the amateur, four or six hand-screws, or ordinary clamps, or the screw-chops of the bench, aided by a string to bind around many of the curvilinear and other works, will generally suffice.

As however the amateur may occasionally require to glue down a piece of veneer, I will, in conclusion, describe the method of "laying it with the hammer," which requires none of the apparatus just described, but the *veneering hammer* alone. This is either made of iron with a very wide and thin pane, or more generally of a piece of wood from three to four inches square, with a round handle projecting from the center; the one edge is sawn down for the insertion of a piece of sheet iron or steel, that projects about one quarter of an inch, the edge of which is made very straight, smooth, and round; and the opposite side of the square wooden head of the veneering hammer is rounded, to avoid its hurting the hand.

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* In some of the large manufactories for cabinet-work, &c., the premises are heated by steam-pipes, in which case they have frequently a close stove in each workshop heated many degrees beyond the general temperature, for giving the final seasoning to the wood, for heating the cauls, and for warming the glue, which is then done by opening a small steam-pipe into the outer vessel of the glue-pot. The arrangement is extremely clean, safe from fire, and the degree of the heat is very much under control.

The table and both sides of the veneer having been toothed, the surface of the table is warmed, and the *outer* face of the veneer and the surface of the table are wetted with very thin glue, or with a stiff size. The inner face of the veneer is next glued; it is held for a few moments before a blazing fire of shavings to render the glue very fluid, it is turned quickly down upon the table, and if large is rubbed down by the outstretched hands of several men; the principal part of the remainder of the glue is then forced out by the veneering hammer, the edge of which is placed in the center of the table, the workman leans with his whole weight upon the hammer, by means of one hand, and and with the other he wriggles the tool by its handle, and draws it towards the edge of the table, continuing to bear heavily upon it all the time.

The pressure being applied upon so narrow an edge, and which is gradually traversed or scraped over the entire surface, squeezes out the glue before it as in a wave, and forces it out at the edge; having proceeded along one line he returns to the center, and wriggles along another part close by the side of the former; and in fact as many men are generally engaged upon the surface of the table as the shop will supply, or that can cluster around it. The veneer is from time to time wetted with the hot size, which keeps up the warmth of the glue, and relieves the friction of the hammers, which might otherwise tear the face of the wood.

The wet and warmth also render the veneer more pliable, and prevent it from cracking and curling up at the edges, as when the glue becomes chilled the veneer will break from the sudden bending to which it is subjected, by the pressure of the hammer just behind the wave of glue, which latter is then too stiff to work out freely, owing to its gradual loss of fluidity; the operation must therefore be conducted with all possible expedition.

The concluding process is to tap the surface all over with the back of the hammer, and the dull hollow sound will immediately indicate where the contact is incomplete, and here the application of the hammer must be repeated ; sometimes when the glue is too far set in these spots, the inner vessel of the glue-pot or heated irons, are laid on to restore the warmth. By some, the table is at the conclusion laid flat on the floor, veneer downwards, and covered over with shavings, to prevent the too sudden access of air. Of course the difficulty of the process increases with the magnitude of the work; the mode is more laborious and less certain than that previously described, although it is constantly resorted to for the smaller pieces and strips of veneer, even where the foregoing means are at hand.

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* The former chapters were in type before the author was aware of the existence of two excellent papers, by A. Aikin, Esq., F.R.S., F.G.S., &c., " On Timber," and " On Ornamental Woods," read before the Society of Arts in 1831, (*see* their Trans. Vol. L., Part ii., p. 140-170.) He is very happy to find, that so far as the present pages treat of parallel parts of this extensive subject, they are in general confirmed by Mr. Aikin, although the construction of the two papers is entirely different.

Mr. Aikin adverts in a very interesting manner to circumstances relative to the growth of the tree in its native forest, and the process of seasoning, &c. ; in which M. Duhamel's great work, *Sur l'Exploitation des Bois*, is referred to : and also to the luxurious employment of ornamental woods amongst the Romans, as derived from the Natural History of Pliny the Elder, (Plin. Hist. Nat. xiii. 29—xvi. 24-34.)

" By far the most costly wood was procured from a tree called citrus, a native of that part of Mauritania which is adjacent to Mount Atlas. In leaf, odour, and trunk, it resembles the female wild cypress. The valuable part is a tuber or warty excrescence, which, when found on the root and under ground, is more esteemed than when growing on the trunk or branches. When cut and polished it presents various figures, of which the most esteemed are curling veins, or concentric spots like eyes, the former being called tiger-wood, the latter panther-wood."—" Tables of this material appear to have been first brought into fashion by Cicero, who is said to have given for a single one a million sesterces, *i. e.* 8072*l.*, &c."—Others of these *solid* tables were sold at greater prices, and one as high as 11,300*l.*

" In the time of Pliny the art of veneering was a recent invention ; and he descants in his usual antithetical way, on thus converting the cheaper into the most valuable woods, by plating them with these latter ; and of the ingenuity of cutting a tree into thin slices, and thus selling it several times over. The woods employed for this purpose were the citrus, the terebinth, various kinds of maple, box, palm, holly, ilex, the root of elder and poplar. The middle part of a tree, he observes, shows the largest and most curling veins, while the rings and spots are chiefly found near the root. The veneers, or plates, were secured, as at present, by strong glue."—Pages 162-4.

CHAPTER VI.

CATALOGUE OF THE WOODS COMMONLY USED IN THIS COUNTRY.

SOURCES FROM WHENCE IT WAS COLLECTED.

In presenting this descriptive catalogue of woods to the reader, it becomes the author's first and pleasing duty, to acknowledge the valuable assistance he has received from numerous kind friends, of various pursuits, acquirements, and occupations; to most of whom he has submitted the manuscript and rough proofs of the catalogue in their various stages through the press, for confirmation or correction, and which has led to the attainment of numerous valuable additions, or he may say, the major part of its contents.

Amongst those to whom he is thus indebted, he has to mention, with gratitude, the following naturalists and travellers, &c.: namely, Arthur Aikin, Esq., late Secretary to the Society of Arts, London; John Fincham, Esq., Principal Builder in Her Majesty's Dockyard, Chatham; Colonel G. A. Lloyd, Her Majesty's Surveyor-General of the Mauritius; G. Loddiges, Esq.; John Macneill, Esq., Civil Engineer; John Miers, Esq., long resident in the Brazils; and also W. Wilson Saunders, Esq., Colonel Sir James Sutherland, and Colonel Sykes, each of the East India Company's Service. The author is likewise indebted, in a similar manner, to the following wood-merchants, manufacturers and others, Messrs. Bolter, Cox, Edwards, Fauntleroy, Jaques, Russell, Saunders, Seddons, Shadbolt, &c., and in a less degree to numerous others.

The extensive botanical notes interspersed, (in a smaller type,) throughout the list of woods, are from the pen of Dr. Royle, to whom he submitted the early proofs of the catalogue, with the request that he would examine the botanical names so far as he had been able to collect them. The unlooked-for and careful manner in which the professor has executed this request, both from his personal knowledge, and also by a very laborious comparison of the scattered remarks in various works on botany and natural history, contained in his select library, will be duly appreciated by those interested in the natural history of the subject, or in the search for the woods themselves, in their various localities, whether for the purpose of science or commerce; and from the mode adopted, the one or the other part of the catalogue may be separately consulted.

To attain the means of comparing the descriptions with the woods themselves, the author has procured a quantity of most of them, those employed in turning especially, from which he has cut his own specimens, (these have been kindly augmented by several of the friends before named,) and he has been fortunate in having purchased a very fine cabinet of seven hundred specimens, collected by a German naturalist, and arranged with the Linnean and German names; all of which are open to the inspection of those who may feel interest therein.

Still further to test the descriptions in the catalogue, he has also carefully examined a variety of museums and collections, from which scrutiny, it would have been an easy task to have extended this list in a considerable degree, by the introduction of the names, localities, and descriptions of a variety of well authenticated specimens of woods, apparently useful; but he has purposely endeavoured to keep himself within the strict limits called for by this work, in noticing those woods only which are used in England, and that may in general be procured there.

For the use of those who may desire to follow this interesting subject with other views, the names of the several museums that have been kindly laid open to his inspection, and a slight notice of their contents, are subjoined in a note.

Many of the remarks on the Timber Woods are derived from that excellent work before named, "Tredgold's Elements of Carpentry:" all the French books on turning, enumerated in the introduction, have been consulted, besides those referred to in the various notes, and some others; and in fact, the author has spared no pains to obtain the most authentic information within his reach, but upon a subject, pronounced by those who have paid attention to it, to be so boundless and confessedly difficult, it is necessary to ask a lenient judgment, and the kind notice and communication of any inaccuracies which may inadvertently exist, notwithstanding his efforts to the contrary.

It is indeed a matter of great and real regret, that upon a subject of general importance, there should in many respects be such a scarcity of exact and *available* information. The true names and localities of some of the most familiar woods, are either unknown or enveloped in considerable doubt; in many cases we have only the commercial names of the woods, and a vague notion of their localities; in others we have authenticity as to their locality and their *native* names; and lastly, we have also very extensive lists and descriptions of woods in botanical works, and in the writings of travellers, &c., but these three nomenclatures are often incompatible, and admit of surmise only, rather than strict and satisfactory comparison, which drawback was strongly experienced by Dr. Royle in collecting the notes attached to the catalogue.

This deficiency arises from the little attention that has been given to the scientific part of the subject by naturalists and travellers, and from the arbitrary manner in which the commercial names are fixed, often from some faint and fancied resemblance*, sometimes from the port whence the woods are shipped, or rather from that whence the vessel "cleared out," or obtained her official papers; as it frequently happens, that the woods are picked up at different points along the coast, the names even of which places cannot be ascertained, much less those of the inland districts or territories in which the woods actually grew.

Naturalists and travellers, and also merchants residing abroad, would therefore confer a great benefit, not only on science, but likewise on the arts, by correcting our knowledge on these points. This might be done by transmitting along with specimens collected on the spot, the exact particulars of their locality, and of the soil; their relative abundance, native names and uses†. In cases of doubt as to their true botanical names, (by which alone their identity can be ensured for future years,) then some of the leaves, fruits, flowers, &c., should if possible be preserved, by which their species might be afterwards exactly determined by those possessed of the requisite knowledge of the vegetable kingdom.

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* The Romans had their tiger and panther woods, namely the pieces of citrus, marked with *stripes* or *spots* (*see* note, page 64); the moderns have partridge, snake, porcupine, zebra, and tulip woods, and others. *See* the Catalogue.

† The specimens should be stamped with numbers, as a preferable mode to affixing labels, and it should be noted whether the tree from which each was cut were of superior, average, or inferior quality, and also its size. It would be still better to collect three or four samples from different trees, and the transverse sections especially with the bark would be highly characteristic.

The trouble of preparing the notes to accompany the specimens, would be greatly diminished by the employment of a tabular form, on the model of that adopted at Lloyd's Registry, described in the note, page 69.

This would also be important in a commercial point of view, as numerous woods, of which small quantities, perhaps one single importation, have been received, might be again obtained, whereas they are now lost, from the absence of these particulars.

The latitude exerts a general influence in the distribution of the woods, but it must be remembered that alone it is insufficient to limit the locality, it must be viewed in connexion with the elevation of the land; for even under the equator, as we ascend the mountains, the products of the temperate and even the frigid zones are met with, as nature appears to set no bounds to her liberality and munificence.

MUSEUMS, ETC., CONSULTED.

THE ADMIRALTY MUSEUM, Somerset House, which is principally due to the superintendence of Sir William Symonds, the Surveyor-General of the Navy, is very rich in specimens of woods. It contains the foundation of a fine collection with their foliage, acorns, cones, and other seed-vessels, &c.; at present the oaks and firs are the most complete: there are also, from Brazil, 56 specimens; from Australia, 13; and from New Zealand, 40; all with native names and foliage. And the following woods, with native names, from various contributors.

N. America, 30, Capt. C. Perry, U.S.N.
Cuba, 168, —— Tyrie, Esq.
Jamaica, 100, Capt. T. M. C. Symonds, R.N.
Brazil, 140, S. Morney, Esq., Engineers.
Brazil, 152, Mr. ——.
Malabar, 25.
Java, 83.
Australia, 25, Sir Thomas Mitchell.
Norfolk Island, 16, —— Leslet, Esq.

This fine museum also includes, amongst others not specified, sets of specimens from the different Government dock-yards, of the timbers used respectively therein. Many of the specimens are worked into cubes and blocks of similar size, and their several weights are marked on each.

Also 84 pieces from the "Gibraltar" of 80 guns, launched in 1751, and recently broken up: these are intended to show the durability of the woods.

EAST INDIA HOUSE.

Indian woods, 117 kinds in form of books, about half with their native names.
—— ——, from Dr. Roxburgh; large pieces of the principal kinds.
—— and Himalayan woods, from Dr. Wallich; 457 specimens.
Java woods, 100 kinds, presented by Dr. Horsfield.

ASIATIC SOCIETY.

Ceylon woods, 255 specimens, with their native names, and alphabetical catalogue.

UNITED SERVICE MUSEUM.

Travancore, 110, with native names, Lieut.-Col. J. M. Frith, Madras Artil., C.B.
New Zealand and New South Wales, 30, R. Cunningham., Esq., Bot. Gard., Sidney.
Ceylon, 31, names in the native character, from Captain Chapman, R.A.
Jamaica, 80, names principally English, from Lieut. J. Grignon, 37th Regt.
Jamaica, 31 large handsome polished specimens, Capt. Ethelred Hawkins, 22d Regt.

SOCIETY OF ARTS.

Indian woods, a duplicate set of Dr. Wallich's collection, namely, 457 specimens enumerated in the Trans. of the Society, Vol. 48, Part 2, pp. 439—479.

India, various parts, Cape of Good Hope, Pitcairn's Islands, &c., 452 specimens, Captain H. C. Baker, Bengal Art. &c. *See* Trans., Vol. 50, Part 2, pp. 173—189.

LLOYD'S REGISTRY OF SHIPPING.

160 specimens of ship-building woods, oaks the most numerous, next firs, pines, elms. They are accompanied by a list which contains seven columns, headed "Stamped number on Specimen, Name of Wood, Place of Growth, Soil, Durable or otherwise, Purpose for which used, Remarks."

PRIVATE COLLECTIONS OF SPECIMENS.

Mr. Fincham's contains most of those in the subjoined list, generally in two sections, with their specific gravities and relative degrees of strength [*]. Also from Nova Scotia, 8 ; Rio Janeiro, 11 ; Isle of France, 34 ; Malabar, 19 ; Ceylon, 59 ; New South Wales, 14 ; Van Diemen's Land, 6 ; New Zealand, 17, all with native names, brought over direct by the captains of Government ships.

G. Loddiges, Esq., F.L.S., F.H.S., F.Z.S., &c., has a fine cabinet. Of the woods of Europe, 100 ; Jamaica, 100 ; Brazils, 250 ; Chili, 45 ; Sierra Leone, 20 ; East Indies, 25 ; South Seas, 33, all with native names ; and 25 from China, marked in that character. Also about 100 commercial and dye woods, and not less than 1000 from all parts of the globe not yet prepared for his cabinet.

J. Miers, Esq., F.L.S., &c., has 75 Brazilian specimens, collected by himself on the spot.

W. Wilson Saunders, Esq., F.L.S., &c.: Brazilian, 70 ; Grecian, 17 ; British, 70 ; various localities, 65.

Mexico. Dr. Coulter, M.D., M.R.I.A., Hon. Fel. Col. Phys., Hon. Fel. Roy. Dub. Soc. &c., has collected 800 specimens in Mexico, 788 with the leaf, flower, and sometimes the fruit. They have been presented by him to Trinity College, Dublin. These I have not seen.

Isthmus of Panamà. *See* Colonel G. A. Lloyd's Notes and Catalogue of Woods, Trans. Royal Geog. Soc., Vol. I., p. 71.

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[*] *Ship-building Woods used in our Government Yards.*

OAKS.—English. Adriatic. Italian. Sussex. New Forest. Canada, white and red. Pollard. Istrian. Live-oak. African. And also Teak.

PINES.—Yellow. Red. Virginian Nil red. Pitch-pine. Riga.

FIRS.—Norway and American spruce fir. Dantzic and Adriatic fir.

LARCHES.—Hackmetack. Polish. Scotch. Italian, 1. 2. 3. Athol. Cowdie, or New Zealand larch.

CEDARS.—Cuba. Lebanus. New South Wales and Pencil cedar.

ELMS.—English and Wych elm.

MISCELLANEOUS WOODS, used in small quantities.—Rock Elm. English and American Ash. Birch, black and white. Beech. Hornbeam. Hickory. Mahogany. Lime-tree. Poon-wood, and Lignum-vitæ, &c.

TABULAR VIEW
OF THE WOODS COMMONLY USED IN THIS COUNTRY.

For Building.

Ship-building.
Cedars.
Deals.
Elms.
Firs.
Larches.
Locust.
Oaks.
Teak, &c. &c.

Wet works, as piles, foundations, &c.
Alder.
Beech.
Elm.
Oak.
Plane-tree.
White Cedar.

House-carpentry.
Deals.
Oak.
Pines.
Sweet Chesnut.

For Machinery and Mill-work.

Frames, &c.
Ash.
Beech.
Birch.
Deals.
Elm.
Mahogany.
Oak.
Pines.

Rollers, &c.
Box.
Lignum-vitæ.
Mahogany.

Teeth of Wheels, &c.
Crabtree.
Hornbeam.
Locust.

Foundry Patterns.
Alder.
Deal.
Mahogany.
Pine.

For Turnery.

Common woods for Toys: softest.
Alder.
Aps.
Beech
Birch } small
Sallow.
Willow.

Best woods for Tunbridge-ware.
Holly
H. Chesnut } white woods.
Sycamore
Apple-tree
Pear-tree } brown woods.
Plum-tree

Hardest English woods.
Beech, large.
Box.
Elm.
Oak.
Walnut.

For Furniture.

Common Furniture and inside works.
Beech.
Birch.
Cedars.
Cherry-tree.
Deal.
Pines.

Best Furniture.
Amboyna.
Black Ebony.
Cherry-tree.
Coromandel.
Mahogany.
Maple.
Oak, various kinds.
Rosewood.
Satin-wood.
Sandal-wood.
Sweet Chesnut.
Sweet Cedar.
Tulip-wood.
Walnut.
Zebra-wood.

Foreign Hardwoods, several of which are only used for Ornamental turnery.

Amboyna.
Beef-wood.
Black Bot.B.-wd.*†
Black Ebony.‡
Box-wood. †‡
Brazil-wood.
Brazilletto.
Bullet-wood.*†
Cam-wood. †
Cocoa-wood.†‡
Coromandel.
Green Ebony.‡
Greenheart.
Grenadillo.‡
Iron-wood.
King-wood.*
Lignum-vitæ. ‡
Locust. ‡
Mahogany. ‡
Maple.
Mustaiba.
Olive-tree and root.
Palmyra.
Partridge-wood.
Peruvian,
Princes-wood.
Purple-wood.
Red Sanders.
Rosetta.
Rose-wood.‡
Sandal-wood.
Satin-wood. ‡
Snake-wood. *
Tulip-wood. *
Yacca-wood.
Zebra-wood.

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* Frequently scarce.

† Generally close, hard, even tinted, and the more proper for eccentric turning, but others may also be employed.

‡ Generally abundant, and extensively used.
All the woods may be used for plain turning.

Miscellaneous Properties.

Elasticity.
Ash.
Hazel.
Hickory.
Lancewood.
S. Chesnut, small.
Snakewood.
Yew.

Inelasticity and toughness.
Beech.
Elm.
Lignum-vitæ.
Oak.
Walnut.

Even grain proper for Carving.
Lime-tree.
Pear-tree.
Pine.

Durability in dry works.
Cedar.
Oak.
Poplar.
Sweet Chesnut.
Yellow deal.

Colouring Matter.

Red Dyes.
Brazil
Brazilletto
Camwood
Logwood
Nicaragua
Red Sanders
Sapan-wood

Green Dye.
Green Ebony.

Yellow Dyes.
Fustic.
Zante.

Scent.
Camphor-wood.
Cedar.
Rosewood.
Sandal-wood.
Satin-wood.
Sassafras.

DESCRIPTIVE CATALOGUE

OF THE

CHARACTERS AND USES OF THE WOODS

COMMONLY EMPLOYED IN THIS COUNTRY

FOR THE

MECHANICAL AND ORNAMENTAL ARTS.

N.B.—The botanical names, the notes printed in a smaller type, and the articles marked with an asterisk, have been added by Dr. Royle, M.D., F.R.S., L.S., & G.S., &c. &c., of the East India House, Professor of Materia Medica and Therapeutics, King's College, London.

ABELE. *See* POPLAR.

ACACIA, true. The *Acacia proxima Mordi*, A. Guillard's MSS., called in Cuba *Sabicù*, and in England *Savico* and *Savacu*, is a heavy durable wood of the red mahogany character, but rather darker and plainer; it is highly esteemed in ship-building.

In the Admiralty Museum the leaves, &c. of the tree are to be seen, and also specimens of the original timbers of the "Gibraltar," of 80 guns, launched in 1751, some of the wood of which is now in such perfect condition, that Sir W. Symonds intends to use the old keel of the Gibraltar, (made of Savico,) for that of a new frigate.

The true acacias are found in warm parts of the world, and yield valuable though usually small timber, which is remarkable for being hard and tough, as *Acacia tortuosa*, called Cashaw tree in the West Indies. On the west coast of Africa, *Acacia verek* has very hard white wood, as well as other species. *A. melanoxylon*, Black wattle tree and Black wood, and *A. decurrens*, Green wattle, occur in New Holland.

In India, *Acacia arabica*, and *farnesiana* commonly called *bubool*, *A. speciosa*, and *A. sundra*, yield timber valued for different purposes. Many of these trees exude gum, and their bark is employed in tanning leather.

ACACIA, false, the common acacia or locust-tree. *See* LOCUST-TREE.

AFRICAN BLACKWOOD. *See* BLACK BOTANY-BAY WOOD.

ALDER, (*Alnus glutinosa*,) Europe and Asia. There are other species in N. America and the Himalayas. The common alder seldom exceeds 40 ft. in height, is very durable under water, and was used for the piles of the Rialto at Venice, the buildings at Ravenna, &c.: the wood is also much used for pipes, pumps, and sluices. The colour of alder is reddish-yellow of different shades, and nearly

ALDER—*continued.*

uniform; the wood is soft, and the smaller trees are much used for inferior turning, as tooth-powder boxes, common toys, brushes, bobbins, &c., and occasionally for foundry patterns. The roots and knots are sometimes beautifully veined, and used in cabinet-work. The charcoal of the alder is employed in the manufacture of gunpowder.

ALOES-WOOD. See CALEMBEG.

ALMOND-TREE, (*Amygdalus communis,*) is very strongly recommended by Desormeaux, as being hard, heavy, oily or resinous, and somewhat pliable; he says, the wood towards the root so much resembles *lignum vitæ,* as to render it difficult to distinguish between them. It is sometimes called false *lignum vitæ,* and is used for similar purposes; as handles, the teeth and bearings of wheels, pulleys, &c., and any work exposed to blows or rough usage. It is met with in the South of Europe, Syria, Barbary, &c. The wood of the bitter almond, grown in exposed rocky situations, is preferred.

AMBOYNA-WOOD. *See* KIABOOCA-WOOD.

ANGICA-WOOD. *See* CANGICA-WOOD.

APS. *See* POPLAR.

APPLE-TREE, (*Pyrus Malus*). The woods of the apple-trees, especially of the uncultivated, are in general pretty hard and close, and of red-brown tints, mostly lighter than the hazel-nut. The butt of the tree only is used; it is generally very straight and free from knots up to the crown, whence the branches spring. The apple-tree splits very well, and is one of the best woods for standing when it is properly seasoned: it is very much used in Tunbridge turnery, for bottle-cases, &c.: it is a clean-working wood, and being harder than chesnut, sycamore, or lime-tree, it is better adapted than they are for screwed work, but it is inferior in that respect to pear-tree, which is tougher. The millwright uses the crab-tree for the teeth of mortice-wheels.

APRICOT-TREE, (*Armeniaca vulgaris,*) a native of Armenia, is mentioned in each of the French works on turning, beginning with Bergeron, (1792,) who says, the wood of the apricot-tree is very rarely met with sound, but that it is agreeably veined, and better suited to turning than carpentry. He elsewhere very justly adds, that we are naturally prejudiced in favour of those trees, from which we derive agreeable fruits, and expect the respective woods to be either handsome in appearance, or agreeable in scent, but in each of which we are commonly disappointed: this applies generally to the orange and lemon trees, and we may add, the quince, pomegranate, and coffee trees, the vine, and many others occasionally met with, rather as objects of curiosity, than as materials applicable to the arts.

* ARBOR VITÆ. The different species of *Thuja,* are called *Arbor vitæ,* and are chiefly found in North America and China. *T. occidentalis* or American *Arbor vitæ,* attains a height of from 40 to 50 feet, and has reddish-coloured,

* **ARBOR VITÆ**—*continued.*
somewhat odorous, very light, soft and fine-grained wood. It is softer than white pine, and much used in house carpentry, and also for fences.

The Chinese *Arbor vitæ*, or *T. orientalis*, is smaller, but the wood is harder. *T. articulata*, a native of the north coast of Africa, is the *Alerce* of the Moors, and was employed in the woodwork of the mosque, now the cathedral, of Cordova. The plant is now called *Callitris quadrivalvis.*

ASH, (*Fraxinus excelsior ;*) Europe and North of Asia ; mean size, 38 ft. long by 23 in. diam., sometimes much larger. The young wood is brownish-white with a shade of green ; the old, oak-brown with darker veins. Some specimens from Hungary with a zigzag grain, and some of the pollards, are very handsome for furniture.

Ash is superior to any other British timber for its toughness and elasticity ; it is excellent for works exposed to sudden shocks and strains, as the frames of machines, wheel-carriages, agricultural implements, and the fellies of wheels, the inside work of furniture, &c. The wood is split into pieces for the springs of bleachers' rubbing boards, which are sometimes 40 feet long ; also for handspikes, billiard cues, hammer handles, rails for chairs, and numerous similar works, which are much stronger when they follow the natural fibre of the wood.

Ash is too flexible and insufficiently durable for building purposes ; the young branches serve for hoops for ships' masts, tubs, churns, &c.

Several species are found in North America : of these, it is thought that the White Ash, or *Fraxinus americana*, comes the nearest in quality of wood to the common ash. *F. floribunda* and *zanthoxyloides* are two ashes found in the Himalayas.

Fraxinus ornus produces manna, *Fraxinus excelsa* produces a manna somewhat similar.

ASH, the MOUNTAIN ASH, or Quicken or Rowan tree, *Pyrus Aucuparia*, grows in almost every soil or situation, has fine-grained hard wood, which may be stained of any colour, and takes a high polish, and is applied to the same purposes as the wood of the Beam and Service trees. See SERVICE-TREE.

ASPEN. See POPLAR.

BARBERRY WOOD, (*Berberis vulgaris,*) is of small size, generally about 4 in. diam. ; the rind is yellow, and about half an inch thick : the wood resembles elder, and is tolerably straight and tenacious.

BAR-WOOD, Africa. Two kinds are imported from Angola and Gaboon respectively, in split pieces 4 to 5 ft. long, 10 to 12 in. wide, and 2 to 3 in. thick. It is used as a red dye-wood, the wood is dark red, but the dye rather pale ; it is also used for violin bows, ramrods, and turning.

BAY-TREE. The sweet bay-tree, (*Laurus nobilis,*) a native of Italy and Greece, grows to the height of 30 feet, and is an aromatic wood. It is the laurel that was used by the ancients for their military crowns.

BEECH. Only one species, (*Fagus sylvatica,*) is common to Europe ; in England the Buckinghamshire and Sussex beech are esteemed the best. Mean dimensions of the tree, 44 ft. long and 27 in. diam. The colour, (whitish-brown,) is influenced by the soil, and is described as white, brown, and black. (*Tredgold.*)

Beech is used for piles in wet foundations, but not for building ; it is excel-

BEECH—*continued.*

lent from its uniform texture and closeness for in-door works, as the frames of machines, common bedsteads and furniture; it is very much used for planes, tools, lathe-chucks, the keys and cogs of machinery, shoe-lasts, pattens, toys, brushes, handles, &c. The carved moulds for the composition ornaments of picture-frames, and for pastry, and the large wooden types for printing, are commonly made of beech : the wood is often attacked by worms.

Beech is stained to imitate rose-wood and ebony, and it is considered to be the most chemically free from foreign matters; for example, the glass-blowers use the wood almost exclusively in *welding*, or fusing on, the handles of glass jugs, which process fails when the smallest portion of sulphur &c. is present : oak is next in estimation for the purpose.

The white beech of North America, *Fagus sylvestris*, is by some thought to be identical with the common beech, but the wood is little valued in America; the bark however is employed in tanning.

BEEF-WOOD. Red-coloured woods are sometimes thus named, but it is generally applied to the Botany-Bay oak—which see.

BIRCH-WOOD, a forest tree common to Europe and North America; the finest is imported from Canada, St. John's, Pictou, &c. It is an excellent wood for the turner, being light-coloured, compact, and easily worked : it is in general softer and darker than beech, and unlike it in grain.

Birch-wood is not very durable, it is very much used in furniture ; some of the wood is almost as handsomely figured as Honduras mahogany, and when coloured and varnished, is not easily distinguished from it. The bark of the birch-tree is remarkable for being harder and more durable than the wood itself, amongst the Northern nations it is used for tiles for roofs, for shoes, hats, &c., and in Canada for boats. The Russians employ the tan of one of the birch-trees to impart the scent to Russia leather, which is rendered thereby remarkably durable. The inner bark is used for making the Russia mats.

The English birch is much smaller than the foreign, and lighter in colour; it is chiefly used for common turnery. Some of the Russian birch (called Russian maple) is very beautiful and of a full yellow colour.

Betula alba is the common birch of Europe, and the most common tree throughout the Russian empire. The Russian maple of commerce is thought to be the wood of the birch. *Betula lenta*, mahogany birch and mountain mahogany, of America, has close-grained, reddish-brown timber, which is variegated and well adapted to cabinet-work. It is imported in considerable quantities into England under the name of American birch.

Betula excelsa, tall, also called yellow birch, has wood much like the last, and *B. nigra*, or black, is also much esteemed. *B. papyracea*, paper or canoe birch, is employed by the North American Indians in constructing their portable canoes. *B. Bhojputtra* is a Himalayan species, of which the bark is used for writing upon and for making the snakes of hookahs.

BITTER-NUT WOOD, a native of America, is a large timber wood measuring 30 inches when squared, plain and soft in the grain, something like walnut.

Juglans amara, white or swamp Hickory or Bitter-nut, and *J. aquatica*, or water bitter-nut hickory, are probably the trees which yield this wood.

BLACK BOTANY-BAY WOOD, called also African Black-wood, is perhaps the hardest, and also the most wasteful of all the woods; the billets are

BLACK BOTANY-BAY WOOD—*continued.*

very knotty and crooked, and covered with a thick rind of the colour and hardness of boxwood; the section of the heart-wood is very irregular, and mostly either indented from without, or hollow and unsound from within; many of the pieces have the irregular scrawling growth that is observed in the wood of the vine. The largest stem of Black Botany-Bay wood I have ever seen, measured transversely, eleven inches the longest and seven and a half the shortest way, but it would only produce a circular block of five inches, and this is fully two or three times the ordinary size.

The wood, when fresh cut, is of a bluish-black, with dark-grey streaks, but soon changes to an intense jet black; of the few sound pieces that are obtained, the largest may perhaps be five inches, but the majority less than two inches diameter. It is most admirably suited to eccentric turning, as the wood is particularly hard, close, free from pores, but not destructive to the tools, from which, when they are in proper condition, it receives a brilliant polish. It is also considered to be particularly free from any matter that will cause rust, on which account it is greatly esteemed for the handles of surgeons' instruments.

The exact locality of this wood has long been a matter of great uncertainty. It has been considered to be a species of African ebony, but its character is quite different and peculiar; I have however recently heard from two independent sources, that it comes from the Mauritius, or Isle of France. Col. Lloyd says the wood is there called *Cocobolo prieto;* that it is not the growth of the Mauritius, but of Madagascar, to the interior of which island Europeans are not admitted; and that it is brought in the same vessels that bring over the bullocks, for the supply of food. The stonemasons of the country use splinters of it as a pencil for marking the lines upon their work; it makes a dark blue streak not readily washed off by the rain.

I have only met with one specimen of this wood in the numerous collections I have searched, namely, in Mr. Fincham's: he assures me that his specimen grew in Botany Bay, and was brought direct from thence with several others, by Captain Woodroffe, R.N. As I have recently purchased a large quantity imported from the Mauritius, it is probable that this wood, in common with many others, may have several localities.

It would be very desirable for the amateur turner that the wood should be selected on the spot, and the better pieces alone sent, as a large proportion is scarcely worth the expense of shipment, but the fine pieces exceed all other woods for eccentric turned works.

BLUE GUM-WOOD. *See* GUM-WOOD.

BOTANY-BAY OAK, sometimes called Beef-wood, is from New South Wales; it is shipped in round logs, from 9 to 14 in. diam. In general colour it resembles a full red mahogany, with darker red veins; the grain is more like the evergreen oak than the other European varieties, as the veins are small, slightly curled, and closely distributed throughout the whole surface.

BOTANY-BAY OAK—*continued.*

It is used in veneer for the backs of brushes, Tunbridge ware, and turnery; some specimens are very pretty.

The trees called Oaks in New South Wales do not belong to the genus *Quercus*, like the European, North American, and Himalayan oaks. There, the tree called Forest Oak, is *Casuarina torulosa;* Swamp Oak is *C. paludosa ;* He Oak is *C. equisitifolia;* while *C. stricta* is called She Oak, and also Beef-wood.

BOXWOOD, (*Buxus sempervirens,*) is distinguished as Turkey and European boxwood. The former is imported from Constantinople, Smyrna, and the Black Sea, in logs felled with the hatchet, that measure from 2 to 6 ft. long, and 2½ to 14 in. diam. The wood is yellow inclining to orange, it has a thin rind with numerous small knots and wens, some of it is much twisted, and such pieces do not stand well when worked ; on the whole however, it is an excellent, sound, and useful wood.

Boxwood is much used for clarionets, flutes, and a great variety of turned works ; it makes excellent chucks, and is selected by the wood-engraver to the exclusion of all other woods. It is also used for carpenters' rules, and drawing scales; although lance-wood, satin-wood, elder, &c., are sometimes substituted for it. Boxwood is particularly free from gritty matter, and on that account its sawdust is much used for cleaning jewellery; it is frequently mentioned by the Roman authors as a wood in great esteem at the period in which they wrote.

Some of the boxwood is as handsomely mottled as fine satin-wood ; but it differs much in colour, apparently according to the age and season at which it is cut, as only a small portion of the Turkey boxwood is of the full yellow so much admired.

European boxwood is imported from Leghorn, Portugal, &c. The English boxwood is plentiful at Boxhill in Surrey, and in Gloucestershire ; it is more curly in growth, softer and paler than the Turkey boxwood ; its usual diameters are from 1 to 5 in. ; it is used for common turnery, and it is preferred by the brass finishers for their lathe-chucks, as it is tougher than the foreign box and bears rougher usage. It is of very slow growth, as in the space of 20 to 25 years it will only attain a diameter of 1½ to 2 inches. A similar wood, imported from America under the name of Tugmutton, was formerly much used for making ladies' fans.

Murraya (*Mackay B. fr. Tavoy*), Specimen 275 of Dr. Wallich's, and 118 of Captain Baker's collection of Indian woods, and *Garipe àpugne bravo* of Mr. ———'s, from the Brazils, (Admiralty,) seem fully equal to boxwood in most respects.

Buxus sempervirens, or common evergreen box, is found throughout Europe, attaining a height sometimes of from 15 to 20 feet. Turkey box is yielded by *Buxus balearica*, which is found in Minorca, Sardinia and Corsica, and also in both European and Asiatic Turkey, and large quantities of it are imported from Constantinople into England.

A new species has lately been introduced from the Himalayas, *Buxus emarginatus*, of Dr. Wallich: this is found of considerable size and thickness, and the wood appears as good and compact as that of the boxwood in use in Europe. Royle, Illust. Himal. Bot. p. 327. On actual comparison the Himalayan boxwood is found to be softer than the common kinds, but is like them in other respects; as may be seen in the wood-cut, figs. 9 and 10, which have been engraved upon a piece of the wood of the Himalayan *Buxus emarginatus*.

BRAZIL-WOOD, called also Pernambuco, was supposed by Dr. Bancroft to have been known as a red dyewood before the discovery of the Brazils, which country, he says, was so named by Europeans from its abounding in this wood. The best kind is from Pernambuco, where it is called *Pao da rainha*, or queen's-wood, and by the natives *ibirapitanga ;* it is also found in the West Indies generally, and is often called Pernambuco-wood. The tree is large, crooked, and knotty, and the bark is so thick, that the wood only equals the third or fourth of the entire diameter ; the leaves are of a beautiful red, and exhale an agreeable odour. The *Pao da rainha* grows to the diameter of 15 or 16 inches, the *Pao Brazil*, an inferior kind, to 50 or 60 in. Brazil-wood is a royal monopoly, and the best quality has the imperial brand mark at the end ; it is shipped in trimmed sticks, from 1 to 4 in. diam. and 3 to 8 ft. long, and its colour becomes darker by exposure to the air. Its principal use is for dyeing ; the best pieces are selected for violin bows and turning.

Cæsalpinia echinata, the *ibirapitanga* of Piso, yields the Brazil-wood of commerce. De Candolle inquires whether it is not rather a species of *Guilandina*. *C. crista*, a native of the West Indies, is called *Bresillet*, because its wood is reddish-coloured like Brazil wood. *C. Sapan* is a native chiefly of the Asiatic Isles and of the Malayan Peninsula ; its wood is like Brazil-wood, and well known in commerce as Sapan-wood.

BRAZILETTO is quite unlike the Brazil wood ; its colour is ruddy orange, sometimes with streaks ; it is imported from Jamaica in sawn logs from 2 to 6 ft. long and 2 to 8 in. diam. with the bark, (which is of the ordinary thickness,) left on them ; and also from New Providence, in small cleaned sticks. Braziletto is thought to be an inferior species of Brazil wood ; it is principally used for dyeing, also for turnery and violin bows.

It is considered to be botanically allied to the above, and is called *Cæsalpinia braziliensis*, a native of the West Indies, but also found in Brazil.

BULLET-WOOD, from the Virgin Isles, West Indies, is the produce of a large tree, with a white sap ; the wood is greenish-hazel, close and hard. It is used in the country for building purposes, and resembles the Greenheart.

A specimen (at Lloyd's Registry, &c.) of the Booley or Bully-tree, from the Quarawtive River, South America, appeared an excellent hard wood, very dense, and of a plain deep purple red.

The name of Bullet-wood is perhaps taken from the *Bois de balle* or bullet-wood of the French, *Guarea trichilioides*, which in Jamaica is called musk or alligator wood. Bullet is perhaps a change from Bully wood, which is that of the bully tree, called also Naseberry bullet tree, or *Achras Sapota* of botanists, described as one of the best timber-trees. The bully-tree of Guiana is also an Achras. The bastard bully-trees of Jamaica are species of *Bumelia*.

BULLET-WOOD, another species so called, is supposed to come from Berbice ; its colour is hazel brown, of an even tint without veins ; it is a very close, hard and good wood, well adapted to general and to eccentric turning, but is not common.

The latter agrees pretty closely with a wood described by Dr. Bancroft as Bow-wood, or *Wasceba*, of Guiana.

Different specimens marked Naseberry bullet-wood, and one of an iron-wood, were exceedingly near to the above, if not identical with it, and the Bull Hoof and Bread Nut Heart, all from Jamaica, approached more distantly.—(United Service and Admiralty Collections.)

BUTTON-WOOD TREE. *See* PLANE-TREE.

CABBAGE-WOOD. *See* PARTRIDGE-WOOD.

CALAMANDER, *Diospyros hirsuta.* *See* COROMANDEL.

CALAMBERRI. *See* COROMANDEL.

CALEMBEG. A wood similar to Sandal-wood in grain, and similarly, but less powerfully, scented; its colour is olive-green, with darker shades. It appears entitled to the name of Green Sandal-wood.

Calembeg, or Calambac, sometimes called Aloes-wood, is the Agallochum of the ancients, and the Agila or Eagle wood of the moderns. It is produced in Siam and Silhet by *Aquilaria Agallocha.* V. Royle, Illustr. p. 171.

CAMPEACHY LOGWOOD. *See* LOGWOOD.

CAMPHOR-WOOD, is imported from China, the East Indies and Brazils, in logs and planks of large size; it is a coarse and soft wood, of a dirty greyish yellow colour, sometimes with broad iron-grey streaks, and is frequently spongy, and difficult to work. It is principally used in England for cabinet-work, turnery, &c. on account of its scent.

The Camphor-tree of Sumatra is *Dryobalanops Camphora,* of which the wood is hard, compact and brownish-coloured; there is a genuine specimen in the museum of King's College, London. The fragrant light-coloured soft wood of which the trunks and boxes from China are made, is supposed to be that of the Camphor-tree of Japan, *Laurus Camphora,* now *Camphora officinalis.* One or more of the tribe of Laurels yield the *Sirwabali* wood of Guiana, which is light, fragrant, and much used in the building of boats, &c.

CAM-WOOD, an African dyewood, is shipped from Rokella, Sierra Leone, &c. in short logs, pieces, roots, and splinters. When first opened, it is tinted with red and orange; the dust is very pungent, like snuff; it would be a beautiful wood if it retained its original colours, but it changes to dark red, inclining to brown. Cam-wood is the best and hardest of the red dyewoods; it is very fine and close in the grain, and suitable to ornamental and eccentric turning.

Cam-wood is yielded by a leguminous plant, which has been introduced into, and flowered in this country, and has been described and figured by Mr. G. Loddiges, in his Botanical Cabinet, vol. iv. t. 367, under the name of *Baphia nitida.*

CANARY-WOOD; the Brazils, Para, &c.; known at the Isthmus of Darien as *Amarillo.* It is imported in round logs from 9 to 14 in. diam., and sometimes in squared pieces. The wood is of a light orange colour, and generally sound; it is straight and close in the grain, and very proper for cabinet-work, marquetry, and turnery; is similar, if not the same, to a wood called Vantatico and Vigniatico, corrupted from *Vinhatico,* a Portuguese name for several yellow woods, besides that imported from the Brazils under the same name.

Laurus indica, or Royal bay, is a native of the Canary Isles. The wood is of a yellow colour, not heavy, but well suited to furniture; it is called *Vigniatico* in the island of Madeira, and is probably what is imported into England under the name of Madeira mahogany: it is less brown than mahogany.

CANGICA WOOD, from the Brazils, also called in England Angica, is of the rosewood character, but of a lighter and more yellow brown, less abrupt, and more fringed, sometimes straight in grain and plain in figure. It is imported in trimmed logs from 6 to 10 in. diam., and is used for cabinet-work and turning.

CEDAR. The name Cedar has been given to trees of very different natural orders, and has occasioned much confusion.

The cedar of Lebanon, or great cedar, (*Pinus Cedrus,*) is a cone-bearing resinous tree, and one of the pines. It is tall and majestic, and grows to a great size; the mean dimensions of its trunk are 50 feet high and 39 inches diam. The wood is of a rich yellowish brown, straight-grained, and it has a peculiar odour. The tree is famous in Scripture for its size and durability (Ezekiel xxxi. 3. 5. 8); it was used in the construction of Solomon's temple at Jerusalem, and many Grecian temples and statues. A few fine trees are said still to remain on Mount Lebanon; but the wood was also procured, in the time of Vitruvius, from other parts of Syria, and from Crete, Africa, &c.—*Tredgold.*

The Pencil cedar is the *Juniperus virginiana;* it is also of the same natural order as the pine-tree. It is imported from North America, in pieces from 6 to 10 inches square. The grain of the wood is remarkably regular and soft, on which account principally, it is used for the manufacture of pencils, and from its agreeable scent, for the inside work of small cabinets; from the same reason it is made into matches for the drawing-room.

Another species is the *Juniperus bermudiana;* it is a much harder and heavier wood than the pencil cedar, with a similar smell and appearance. It was formerly much used in ship-building: many of the timbers of the Spanish ships taken in the last war were of the Bermuda cedar.

" Up to this time there are great quantities of the finest cedar growing in the British island of Bermuda, and the best ships and schooners are always built of it; it is imperishable."—*G. A. Lloyd.*

The cedar known to cabinet-makers by the name of Havannah cedar, is the wood of the *Cedrela odorata* of Linnæus, and belongs to the same natural order as mahogany, which it resembles, although it is softer and paler, and without any variety of colour. It is imported in considerable quantities from the island of Cuba, and is excellent for the insides of drawers and wardrobes: all the cigar-boxes from Havannah are made of this kind of cedar, the wood is brittle and porous. Some kinds of the Havannah cedar are not proper for cabinet-work, as the gum oozes out and makes the surface of the work very sticky and unpleasant.

There is another kind more red in colour, called red cedar; there are also white cedars common to America: one kind is called prickly cedar from its being covered with spines, this is very like the white hemlock, and grows to 4 ft. diam. and 60 to 70 ft. high, and is much used for railway works.

Another sort, from New South Wales, is the wood of the *Cedrela Toona;* it is somewhat similar to the Havannah, but more red in colour, and of a coarser grain; it sometimes measures 4 feet diameter. This kind is also found in the East Indies; it is in common use in joinery-work. Most of the cedars have been used for ship-building.

The Himalayan cedar (*Juniperis excelsa*) is harder and less odoriferous

CEDAR—*continued.*

than the Pencil cedar, but is an excellent light wood between pencil cedar and deal in general character.—(Dr. Wallich's Collection, 202.)

The cedar of Lebanon is usually called *Pinus Cedrus*, but sometimes *Cedrus Libanus;* the lofty *Deodara*, a native of the Himalayas, with fragrant and almost imperishable wood, and often called the Indian cedar, is sometimes referred to the genus *Pinus*, and sometimes to that of *Cedrus* or *Larix*, with the specific name of *Deodara*.

The wood of several of the Coniferæ is however called cedar. The wood of *Juniperus virginiana* is called Red or Pencil Cedar, and that of *J. bermudiana* is called Bermuda Cedar; of *J. barbadensis*, is called Barbadoes Cedar; while the Juniper of the North of Spain, and South of France, and of the Levant, is called *J. oxycedrus:* the White Cedar of North America, a less valuable wood than the red cedar, is yielded by *Cupressus Thyoides*, and the cedar-wood of Japan, according to Thunberg, is a species of cypress.

The name cedar is however applied to a number of woods in our different colonies, which are in no way related to the *Coniferæ;* thus the cedar of Guiana is the wood of *Icica altissima*, white wood or white cedar of Jamaica is *Bignonia leucoxylon*, and bastard cedar is *Guazuma ulmifolia*. In New South Wales again the term white cedar is applied to *Melia Azederach*, and red cedar to that of *Flindersia australis*, as well as to the wood of the Toon-tree, or *Cedrela Toona*.

CHERRY-TREE, is a hard, close-grained wood, of a pale red brown, that grows to the size of 20 or 24 inches, but it is more usually of half that size. When stained with lime, and oiled or varnished, it closely resembles mahogany; it is much used for common and best furniture, chairs, &c., and is one of the best brown woods of the Tunbridge turners. The wood of the black-heart cherry-tree is considered to be the best. "The Spanish American cherry-tree is very elastic, and is used for felucca masts."—*Col. Lloyd.*

Cerasus avium is the wild cherry. *C. duracina* is the heart cherry or Bigarreau. The wood of C. Mahaleb is much used by the French, and is called *bois de Sainte Lucie.*

CHESNUT, (*Castanea vesca*,) is common to Europe; mean size 44 ft. high, 37 in. diam.; is very long-lived and durable. The sweet, or Spanish chesnut, is very much like oak, and is sometimes mistaken for it; it was formerly much used in house carpentry and furniture. The young wood is very elastic, and is used for the rings of ships' masts, the hoops for tubs, churns, &c. but the old wood is considered to be rather brittle.—*See* HORSE CHESNUT.

The edible or sweet chesnut, is the *Castanea vesca*, but the Horse Chesnut (which see) belongs to a very different genus. The wood, formerly much used in house-building and carpentry, and which, famed for its durability, has been mistaken for chesnut, is now considered to be that of an oak, *Quercus sessiliflora.*

COCOA-WOOD, or Cocus, is imported from the W. Indies in logs from 2 to 8 in. diam. sawn to the length of 3 to 6 ft., tolerably free from knots, with a thick yellow sap: the heart, which is rarely sound, is of a light yellow brown, streaked, when first cut with hazel and darker brown, but it changes to deep brown, sometimes almost black. The cocoa-wood is much used for turnery of all kinds, and for flutes; it is excellent for eccentric turning, and in that respect is next to the African black wood.

An apparent variety of cocus-wood from 2 to 6 or 7 inches diameter, with a large proportion of hard sap of the colour of beechwood, and heart wood of a chesnut brown colour, is used for tree-nails and pins, &c. for ship-work, and purposes similar to lignum-vitæ, to which it bears some resemblance, although it is much smaller, has a rough bark, the sap is more red, COCOA-WOOD—*continued.*

and the heart darker and more handsomely coloured when first opened than that wood; it is intermediate between it and cocoa-wood. Another but inferior wood, exactly agrees with the ordinary cocoa-wood, but that the heart is in wavy rings, alternately hard and soft.

Cocoa-wood has no connection with the Cocoa-nut, which is the fruit of a palm-tree common to the East and West Indies, the *Cocos nucifera;* neither can it have any relation to the other endogenous trees which produce the Coquilla nut, the *Attalia funifera*, according to Martius, and *Cocos lapidea* of Gærtner, or of the *Cacao Theobroma,* or the Chocolate-nut tree.

It is really singular that the exact localities and the botanical name of the cocoa-wood, that is so much used, should be uncertain: it appears to come from a country producing sugar, being often imported as *dunnage*, or the stowage upon which the sugar hogsheads are packed: it is also known as Brown Ebony, but the *Amerimnum Ebenus* of Jamaica seems dissimilar.

I have scarcely found any specimens of it in the various collections recently examined. The piece in Mr. G. Loddiges' collection from Rio Janeiro, (with Portuguese names) was marked Cocoa, by which it is generally designated in this country, as cocus-wood is the name given by the wholesale merchant. The cogwood of the West Indies, used for the cogs of wheels and building purposes, is a similar but lighter-coloured wood of larger size.

In Mr. Tyrie's collection of Cuba woods, in Sir W. Symonds's museum, there are nine woods of about the same density and general character as cocoa-wood; they are arranged the lightest first, with their Spanish names; the figures denote the apparent diameters of the trees from which the specimens were cut: No. 108, *Acacio real*, hazel brown, slightly veined, (8 inches); No. 141, *Navaco*, very like cocoa but much lighter (3 in.); No. 144, *Gateado*, more veined, ruddy cast (4 in.); No. 5, *Yayti*, slightly darker than last, with greenish cast; No. 12, *Almiqui*, chesnut-brown, only more ruddy, very rich tint (4 in.); No. 133, *Cerillo*, the complexion of tolerably dark walnut, sap is paler than cocoa, (5 in.); No. 42, *China*, very near to cocoa in colour, specimen had a very small heart and much sap; No. 101, *Granadilla*, greenish cast, (3 in.); No. 72, *Mabao*, rather darker than cocoa, the heart apparently 15 or 18 in. diam., one inch of sap left on the specimen; Nos. 108, 12, and 72, appear to be desirable woods.

The Cocus wood of commerce is not easy to trace to any of the trees of the West Indies, the cocoa plum is *Chrysobalanus Icaco*, which forms only a shrub; *Coccoloba uvifera*, or mangrove grape tree, grows large and yields a beautiful wood for cabinet-work, but which is light and of a white colour. In appearance and description it comes near to the Greenheart or *Laurus chloroxylon*, which is also called Cogwood.

COCOA-NUT TREE and COCOA-NUT. *See* PALMS, and SUPPLEMENT.

COCUS. *See* COCOA-WOOD.

COFFEE-TREE (*Coffea arabica*). The wood is of a light greenish-brown or dusky-yellow, with a bark externally resembling boxwood, but thicker and darker. The specimen I have is nearly as close-grained and hard as box-

COFFEE-TREE—*continued.*

wood; it has no smell, and but little taste. The tree does not grow more than a few feet high, and it is cut down in the plantations to five or six feet, and is not therefore useful in manufactures.

* The tree called Kentucky coffee-tree, or hardy *bonduc*, is very different from the common coffee; it forms a large tree called *Gymnocladus canadensis;* the wood is compact, of a rosy hue, and used by cabinet-makers.

CORAL-WOOD, says Bergeron, is so named from its colour. When first cut it is yellow, but soon changes to a fine red or superb coral; it is hard, and receives a fine polish: he also speaks of a damasked coral-wood. It is difficult to associate these with the red woods; they are perhaps, from the descriptions, nearest to the cam-wood from Africa.

The coral-tree, so called from the colour of its flowers, is *Erythrina Corallodendron;* but the *bois de corail* of the French, is the wood of *Adenanthera pavonina*, which is hard, reddish-coloured, and sometimes confounded with red sanders wood.

COQUILLA NUT. *See* Supplement after Z.

COROMANDEL, or Calamander, the produce of Ceylon, and the coast of India, is shipped in logs and planks from Bombay and Madras. The figure is between that of rose-wood and zebra-wood; the colour of the ground is usually of a red hazel brown, described as chocolate brown with black stripes and marks. It is said to be so hard as almost to require grinding rather than cutting; this is not exactly true, as the veneer saws cut it without particular difficulty: it is a very handsome furniture wood and turns well; it is considered to be a variety of ebony.

Mr. Laird says there are three varieties of Coromandel; the *Calamander or Coromandel*, which is the darkest, and the most commonly seen in this country; the *Calemberri*, which is lighter coloured and striped, and the *Omander*, the ground of which is as light as English yew, but of a redder cast, with a few slight veins and marks of darker tints. He says, the wood is scarce and almost or quite limited to Ceylon; that it grows between the clefts of rocks, which renders it difficult to extract the roots, which are the most beautiful parts of the trees.

The Calamander-wood tree is *Diospyros hirsuta*, and Kadum Bèriya is *D. Ebenaster*, according to Moore's Catalogue of Ceylon Plants, and therefore of the same genus as the true Ebony.

COROMANDEL, falsely so-called, has a black ground, and is either striped, mottled, or dappled, with light yellow, orange, or red; it is a description of accidental or imperfect East Indian black ebony. Some of the pieces are very handsome; it is used for similar purposes to the above, from which, however, it is entirely different, and generally inferior, although it is considered a variety of the same group.

COROSOS, or Ivory Nut. *See* Supplement after Z.

COWDIE. *See* PINES.

CRAB-TREE, the wild Apple-tree; principally used by millwrights for the teeth of wheels. *See* APPLE-TREE.

CYPRESS-TREE. Of this there are many varieties : the principal are the *Cupressus sempervirens,* and the white cypress or white cedar of North America, the *Cupressus Thyoides :* the latter is much used as a timber wood, it is an immense tree, and is considered to be more durable even than the cedar of Lebanon. The *Cupressus sempervirens* is said to have been much used by the ancients; by the Egyptians for the cases for some of their mummies, by the Athenians for coffins, and for the original doors of St. Peter's at Rome, which, on being replaced after six hundred years by gates of brass, were found to be perfectly free from symptoms of decay, and within, to have retained part of the original odour of the wood.—*Tredgold.*

It is probable that the wood of *Thuja articulata,* (see Arbor vitæ,) was also used by the ancients, and has sometimes been mistaken for that of Cypress.

DEAL. *See* PINES.

DOG-WOOD, a small underwood, which is so remarkably free from silex, that little splinters of the wood are used by the watchmaker for cleaning out the pivot-holes of watches, and by the optician for removing the dust from small deep-seated lenses ; dogwood is also used for butchers' skewers, and tooth-picks.

The charcoal of the black dog-wood is employed in the manufacture of the best sporting gunpowder, alder and willow charcoal for the government powder.—*Wilkinson's Engines of War,* 1841.

Cornus sanguinea is the wild cornel or common dogwood, *C. mas.* is the male dogwood or Cornelian cherry, while *C. florida* is an American species; others are found in the Himalayas. The name dogwood is applied in Jamaica to *Piscidia Erithrina.*

* **EAST INDIAN BLACK-WOOD,** (*Dalbergia latifolia,*) called Blackwood tree by the English and *Sit Sâl* by the natives of India, on the Malabar coast, where it grows to an immense size. The wood of the trunk and large branches is extensively used for making furniture ; it is heavy, sinking in water, close grained, of a greenish or greenish black colour, with lighter coloured veins running in various directions, and takes a fine polish.

EBONY is described as of several colours, as yellow, red, green, and black. The existence of yellow and red ebonies appears questionable. The black ebony is the kind always referred to when the name is mentioned alone ; in fact, "as black as ebony," is an old proverb. The wood is surrounded by a white sap 3 or 4 inches thick. The green ebony is an entirely different tree, with a thin smooth bark, growing in the West Indies.

Three kinds are imported ; No. 1, from the Mauritius, in round sticks like scaffold poles, they seldom exceed 14 in. diam. ; No. 2, the East Indian which grows in Ceylon, the East India islands, and on the continent of India, this is mostly shipped from Madras and Bombay in logs from 6 to 20 and sometimes even 28 in. diam., and also in planks ; and No. 3, the African ebony, shipped from the Cape of Good Hope in billets, the general size of which are from 3 to 6 ft. long, 3 to 6 in. wide, and 2 to 4 in. thick : these are rent out of the trees, and are often called billet-wood.

No. 1, the Mauritius, is the blackest and finest in the grain, as well as the hardest and most beautiful of the three, but also the most costly and

EBONY—*continued.*

unsound; No. 2, the East Indian, is less wasteful, but of an inferior grain and colour to the above; and No. 3, the African, is the least wasteful, as all the refuse is left behind, and all that is imported is useable, but it is the most porous, and the worst in point of colour.

They are all used for cabinet, mosaic, and turnery works; also for flutes, the handles of doors, knives, and surgeons' instruments, and many other purposes. Piano-forte keys are generally made of the East Indian variety.

The African stands the best, and is the only sort used for sextants.

Colonel Lloyd says, the Mauritius ebony when first cut is beautifully sound, but that it splits like all other woods from neglectful exposure to the sun. The workmen who *use* it, immerse it in water as soon as it is felled for 6 to 18 months, it is taken out and the two ends are secured from splitting by iron rings and wedges. He considers the Mauritius ebony to be the finest, next the Madagascar, and afterwards the Ceylon.

In Mr. Fincham's collection there is a specimen of White Ebony from the Isle of France; it resembles boxwood in most of its characters. There is also a specimen of Young Ebony, of similar description, or rather more like ash in general tint, intermixed with light iron grey streaks or stains, as if the black were in course of deposition. And in Capt. Baker's collection at the Society of Arts, there are nine different specimens of *Diospyros*, two only of which are black, the remainder, more or less like the above.

The black ebony is also met with in South America, but much less generally than in Asia and Africa.

The ebony of Mauritius is yielded by *Diospyros Ebenus*, that of Ceylon is *D. Ebenaster*, while the ebony tree of the Coromandel coast is *D. melanoxylon*; other species, as *D. tomentosa* and *D. Roylei*, yield ebony on the continent of India. The tree yielding the African ebony is not ascertained. A kind of ebony is produced by *Amerimnum Ebenus*, in the West Indies, and called Jamaica ebony.

MOUNTAIN EBONY. The different species of *Bauhiniæ* are so called: *B. porrecta* grows on the hills in Jamaica, and has wood which is hard and veined with black.

See GREEN EBONY and COROMANDEL.

ELDER, (*Sambucus nigra*). The branches of the elder contain a very light kind of pith, which is used when dried for electrical purposes. The surrounding wood is peculiarly strong and elastic. The trunk-wood is tough and close-grained; it is frequently used for common carpenters' rules and inferior turnery-work, for weavers' shuttles, (many of which are also made of boxwood,) for fishermen's netting pins, shoemakers' pegs, &c.

ELM (*Ulmus*), a European timber tree, of which there are five species; mean size, 44 ft. long, 32 in. diam. The heart wood is red brown, darker than oak, the sap yellowish or brownish white, with pores inclined to red; the wood is porous and cross-grained, and shrinks and twists much in drying. Elm is not liable to split, and bears the driving of nails or bolts better than any other timber, and it is exceedingly durable when constantly wet; it is therefore almost always used for the keels of vessels, and for wet foundations, waterworks, piles, pumps, boards for coffins, &c.; and from its toughness it is selected for the naves of wheels, shells for tackle-blocks, and some-

ELM—*continued.*

times for the gunwales of ships, &c., and also for many purposes of common turnery, as it bears very rough usage without splitting.

WYCH ELM. This sometimes grows to the height of 70 feet, and the diameter of 3½ feet; the branches are principally at the top; the wood is lighter and more yellow in colour than the above, and also straighter and finer in the grain. It is tough, and similar to young sweet chesnut for bending, and is much used by shipwrights for jolly-boats, &c., also by coachmakers.

ROCK ELM appears very like the last; it is extensively used for boat-building, and is considered to bend very well.

Ulmus campestris is the common small leaved elm, *U. effusa* is the spreading branched, *U. glabra* is the smooth leaved, and *U. montana* the Wych elm. *Ulmus Americana*, or the American elm, is used for the same purposes as the European species, though the wood is inferior in quality. *U. fulva* and *alata* are other American species, and several species are found in the Himalayas.

FIRS AND PINES. *See* PINES.

FUSTIC, is the wood of a species of Mulberry, (*Morus tinctoria*,) growing in most parts of South America, the United States, and West Indies. It is a large and handsome tree; it is shipped in trimmed logs from 2 to 4 ft. long, 3 to 8 in. diam.; the colour of the wood is a greenish yellow, it is principally used for dyeing greens and yellows, and also in mosaic cabinet-work and turning. *See* ZANTE, or YOUNG FUSTIC.

GRENADILLO, Granillo, or Grenada Cocus, from the West Indies, is apparently a lighter description of the common cocoa or cocus, but changes ultimately to as dark a colour, although more slowly. It is frequently imported without the sap.

The tree yielding this has not been ascertained, the *bois de Grenadille* of the French is also called red ebony by their cabinet-makers.

GREEN EBONY, from Jamaica, and the West Indies generally. It is cut in lengths of 3 to 6 ft.; has a bark much like cocus, but thinner and smoother; the heart wood is of a brownish green, like the green fig. It is used for round rulers, turnery, and marquetry-work, and it cleaves remarkably well. The dust is very pungent, and changes to red when the hands are washed with soap and water. The wood is very much used for dyeing, and it contains so much resinous matter, that the negroes in the West Indies employ it in fishing as a torch. The candle-woods of the West Indies obtain their name probably from the same circumstance; they are allied to the rose-woods, but are of lighter yellow colours.

The ebony of Jamaica is *Amerimnum Ebenus*, and has been mentioned under Ebony. The wood is described as being of a fine greenish brown colour, hard, durable, and capable of taking a fine polish; *B. leucoxylon* of South America yields *le bois d'ébène verte*.

GREENHEART; Jamaica, Demerara and the Brazils; bears a general resemblance to cocoa wood both in size and bark, but the latter has a redder tint. Greenheart when first cut is of a light green brown, and striped, but it changes to the colour of *Lignum Vitæ*, and is by some considered to be per-

GREENHEART—*continued.*

nicious. It is used for turnery and other works, but its texture is coarse, and it will not cleave at all profitably.

Greenheart used in ship-building is entirely different from the above, and runs into several varieties.

Dr. Bancroft describes Greenheart, or the *Sipiera* tree, to be in size like the locust-tree, say 60 or 70 feet high : there are two species, the black and the yellow, differing only in the colour of their bark and wood. He says there is also a purple heart wood, of a bright crimson colour, but which changes to purple, and is esteemed more valuable than the preceding.—*Dr. Bancroft's Guiana*, p. 68—9.

These descriptions exactly agree with Mr. Fincham's specimens described as Greenheart, and black and brown Greenheart ; they are large heavy woods and of olive green even tints, varying from very pale to dark. These, as well as the Purple-heart woods, are used for ship-building, but more particularly in their native countries ; they appear excellent also for the lathe.

The greenheart of Jamaica and Guiana, is the *Laurus Chloroxylon* of botanists ; it is also called Cogwood in the former, and *Sipieri* in the latter locality.

GUM-WOOD, or blue Gum-wood, is the produce of New South Wales ; it is sent over in large logs and planks ; the colour is similar to that of dark Spanish mahogany, with a blue, sometimes a purple grey cast : it is used in ship-building. There is also a variety of a redder tint called red Gum-wood, which is used for ramrods ; both are also employed by the turner.

Eucalyptus piperita is the blue gum-tree of New South Wales, while red gum-tree is another species, probably *E. resinifera.*

HACKMETACK LARCH. *See* Pines.

HARE-WOOD. *See* Sycamore.

HAWTHORN, (*Cratægus oxyacantha,*) has hard wood of a whitish colour, with a tinge of yellow ; the grain is fine, and the wood takes a good polish, but being small and difficult to work it is not much used.

HAZEL, a small underwood, but little used for turning, except for a few toys. It is very elastic, and is used, as well as the ground ash, for the rods of blacksmiths' chisels, hoops of casks, &c. Its botanical name is *Corylus Avellana.*

HICKORY, or White Walnut, (*Juglans alba,*) is a native of America ; it is a large tree, sometimes exceeding 3 ft. diameter. The wood of young trees is exceedingly tough and flexible, and makes excellent handspikes, and other works requiring elasticity. The bark of hickory is recommended by Dr. Bancroft as a yellow dye.

HOLLY, (*Ilex æquifolium,*) is a very clean, fine-grained wood, the whitest and most costly of those used by the Tunbridge-ware manufacturer, who employs it for a variety of his best works, especially those which are to be painted. It is closer in texture than any other of our English woods, and does not readily absorb foreign matters, for which reason it is used for painted screens, the squares of draft-boards, and for the stringings or lines of

HOLLY—*continued.*
cabinet-work, both in the white state and when dyed black, also for some of the inside works of piano-fortes, harps, for calico-printers' blocks, &c. When larger wood than holly is required, the horse-chesnut is employed, but the latter is much softer.

The holly requires very particular care in its treatment: immediately it is felled it is prepared into pieces of the form ultimately required, as planks, veneers, or round blocks for turning, &c. The veneers are hung up separately to dry, as resting in contact even for two or three hours would stain them ; the round blocks are boiled in plain water for two or three hours, and on removal from the copper they are thrown in a heap and closely covered up with sacking to exclude the air, which would otherwise cause them to split. The heap is gradually exposed as it dries, and at the end of about four weeks the pieces look greenish, and covered with mildew sometimes as thickly as one-sixteenth of an inch ; this is brushed off at intervals of three or four weeks, and in about six months the wood will be fit for use.

It is a remarkably tough clean wood, and is used for chucks ; but this troublesome preparation to whiten the wood, (and which is not generally practised on other woods,) is not then required, although a good boil hastens the extraction of the sap, and the subsequent seasoning of the wood. Birdlime is prepared from the middle bark of the Holly.

There is an American species of this genus, the *Ilex opaca*, opaque-leaved or American holly, of which the wood is employed in turnery and cabinet-making ; there are other species in the Himalayas.

HORNBEAM, (*Carpinus Betulus,*) sometimes also called yoke-elm, is a very tough and stringy European wood, which is used by millwrights for the cogs of wheels ; also for skittles, plumbers' dressers, or mallets, and a variety of things required to bear rough usage. Hornbeam is sometimes used for planes, it turns very well, and is occasionally imported from America.

HORSE-CHESNUT, (*Æsculus hippocastum,*) has no relation to the Spanish or sweet chesnut, which latter is more nearly allied to the oaks. The horse-chesnut is one of the white woods of the Tunbridge turner ; it is close and soft, even in the grain, and is much used for brush backs ; it turns very well in the lathe, and is a useful wood. It is softer than holly, but is preferable to it for large painted and varnished works, on account of its greatly superior size.

HORSE-FLESH WOOD, one of the Mangroves, which see.

INDIAN BLACK-WOOD. *See* East Indian Black-wood.

IRON-WOOD, is imported from the Brazils, the East and West Indies, and other countries, in square and round logs, 6 to 9 in. and upwards through. Its colours are very dark browns and reds, sometimes streaked, and generally straight grained.

A specimen in Mr. Fincham's collection, from the Isle of France, was as light in colour as pencil cedar, but of a yellower brown ; and in the same cabinet a piece called Iron Bark, from New South Wales, had the

IRON-WOOD—*continued.*

density of s. g. 1426, and the strength of 1557, (English oak being called 1000,) in appearance it resembled plain brown Spanish mahogany, and it seemed to be not only the heaviest but the most solid of the woods; Mr. Fincham considers that the Australian woods, taken on the whole, are the most dense with which we are acquainted.

The iron-woods are commonly employed by the natives of uncivilized countries for their several sharp-edged clubs and offensive weapons; in England they are principally used for ramrods, walking-sticks, for turning, and various purposes requiring great hardness and durability: the more red varieties are frequently called beef-wood.

Iron-wood is a term applied to a great variety of woods, in consequence of their hardness, and almost every country has an iron-wood of its own. *Mesua ferrea,* which has received its specific name from the hardness of its wood, is a native of the peninsula of India and of the islands.

Metrosideros vera is called true iron-wood: the Chinese are said to make their rudders and anchors of it, and among the Japanese it is so scarce and valuable, that it is only allowed to be manufactured for the service of their king. The iron-wood of southern China is *Baryxylum rufum;* of the island of Bourbon *Stadmannia Sideroxylon*, and of the Cape of Good Hope *Sideroxylon melonophleum,* which latter is very hard, close-grained, and sinks in water.

The iron-wood of Guiana is *Robinia Panacoco* (of Aublet); that of Jamaica is *Fagara Pterota*, and also *Erythroxylum areolatum,* which is also called red-wood. *Ægiphila martinicensis* and *Cocoloba latifolia*, are other West Indian trees, to the woods of which the name of iron-wood has been applied.

Ostrya virginica, called American hop hornbeam, has wood exceedingly hard and heavy, whence it is generally called iron-wood in America, and in some places lever-wood.

JAK-WOOD, is the wood of *Artocarpus integrifolia,* or the entire-leaf bread-fruit tree, a native of India. The wood is imported in logs from 3 to 5 feet diam. and also in planks; the grain is coarse and crooked, and often contains sand; is yellow when first cut, but changes to a dull red or mahogany colour. It is very much used in India for almost every purpose of house carpentry and furniture, and in England for cabinet-work, marquetry, and turning, and also for brush-backs. The jak-wood is very abundant, and the fruit is commonly eaten by the natives; and also by Europeans at dessert, with salt and water like olives. The jak-wood is sometimes mis-named orange-wood from its colour, and also jack-wood, *Jaack*-wood and *Kuthul. See* BAKER'S PAPERS.

JACARANDA, the Portuguese and continental name for Rose-wood, which see.

* JUNIPER-WOOD. The wood of all the species is more or less aromatic, and very durable; they are found in the cold and temperate parts of the world. Some have already been mentioned under the head of Cedar. The common juniper, *Juniperus communis,* has wood which is aromatic, finely veined, and of a yellowish brown colour; *J. excelsa,* lofty or Himalayan cedar, is found on those mountains, as well as in Siberia and North America.

KIABOOCA-WOOD, or AMBOYNA WOOD, imported from Sincapore, appears to be the excrescence or burr of some large tree; it is sawn off in slabs from 2 to 4 ft. long, 4 to 24 in. wide, and 2 to 8 in. thick; it resembles the burr of the yew-tree, is tolerably hard, and full of small curls and knots; the

KIABOOCA-WOOD—*continued.*
colour is from orange to chesnut-brown, and sometimes red brown. It is a very ornamental wood, that is also much esteemed in China and India, where it is made into small boxes and writing-desks, and other ornamental works, the same as by ourselves.

The Kiabooca is said by Prof. Reinwardt, of Leyden, to be the burr of the *Pterospermum indicum;* by others that of *Pterocarpus draco*, from the Moluccas, the island of Borneo, Amboyna, &c. The native name appears, from Mr. Wilson Saunders' specimen, to be *Serioulcut:* the wood itself is of the same colour as the burr, or rather lighter, and in grain resembles plain mahogany.

"The root of the cocoa-nut tree is so similar, when dry and seasoned, to the 'bird's-eye' part of the wood here termed kiabooca, that I can perceive no difference; the cocoa has a tortuous and silky fracture, almost like indurated asbestos."—*G. A. Lloyd.*

The comparison of the palm wood with the kiabooca, renders the question uncertain, as amongst the multitudes of ordinary curly woody fibres, that one cannot account for in a palm, there are a few places with soft friable matter much resembling its cement.

KING-WOOD, called also Violet-wood, is imported from the Brazils, in trimmed logs from 2 to 7 in. diam., generally pipy, or hollow in the heart. It is beautifully streaked in violet tints of different intensities, finer in the grain than rose-wood, and is principally used in turning and small cabinet-work; being generally too unsound for upholstery. It is perhaps one of the most beautiful of the hard woods in appearance.

The specimen in my German cabinet is marked *Spartium Arbor. Trifol. lign. violaceo barrillieri.* It is also marked Guiana-wood, and King-wood. The description is sufficiently distinct, but the arbitrary nature of many of the names renders it difficult to be traced in books.

KOURIE. *See* PINES.

LABURNUM, (*Cytisus Laburnum,*) possesses poisonous seeds, and a small dark greenish-brown wood, that is sometimes used in ornamental cabinet-work and marquetry. Mr. Aikin says: "In the Laburnum there is this peculiarity, which I have not observed in any other wood, namely, that the medullary plates, which are large and very distinct, are white, whereas the fibres are a dark brown; a circumstance that gives quite an extraordinary appearance to this wood."—Page 160.

The Alpine laburnum, with blackish wood, is *Cytisus alpinus.*

LANCE-WOOD is imported in long poles from 3 to 6 in. diam. from Cuba and Jamaica; it has a thin rind, externally similar to that of cocoa-wood; it is called one of the rough-coated woods, and has a bark distinct from the sap-wood, but together they are very thin. Lance-wood is of a paler yellow than box, and rends easily; it is selected for elastic works, such as gig shafts, archery bows and springs, these are bent by boiling or steaming, &c. also

LANCE-WOOD—*continued.*

for surveyors' rods, billiard-cues, and for ordinary rules which are described as box-wood.

In Captain Baker's Papers an Indian Lancewood is called *Menaban.*

The lance-wood of Jamaica is *Guatteria virgala*, formerly *Uvaria lanceolata.* That of Guiana is an *Anonaceous* plant, and probably the same species.

LARCH. *See* PINES.

LETTER-WOOD. *See* SNAKE-WOOD.

LEMON-TREE. *See* ORANGE-TREE.

LEOPARD-WOOD. *See* PALMS.

LIGNUM-VITÆ, or *Guaiacum*, is a very hard and heavy wood. It is shipped from Cuba, Jamaica, St. Domingo, and New Providence, in logs from 2½ to 36 in. diam. Col. Lloyd says, that it grows in the Isthmus of Darien to the size of 5 or 6 ft. and is there called *Guallacan*, and that it is one of the most abundant woods of the country. When first cut, it is soft and easily worked ; but it becomes much harder on exposure to the air. The wood is cross-grained, covered with a smooth yellow sap like box, almost as hard as the wood, which is of a dull brownish green, and contains a large quantity of the gum guaiacum, which is extracted for the purposes of medicine. Lignum-vitæ is much used in machinery, &c. for rollers, presses, mills, pestles and mortars, sheaves for ship-blocks, skittle-balls, and a great variety of other works requiring hardness and strength. It was employed by the Spaniards for making gun-carriages and wheels. It is one of the heaviest of the woods.

The fibrous structure of this wood is very remarkable : the fibres cross each other sometimes as obliquely as at an angle of 30 degrees with the axis, as if one group of the annual layers wound to the right, the next to the left, and so on, but without much apparent exactitude.

The wood can hardly be split, it is therefore divided with the saw ; and when thin pieces, such as old sheaves, are broken asunder, they exhibit a fracture more like a mineral than an ordinary wood. The chips, and even the corners of solid blocks, may be lighted in the candle and will burn freely from the quantity of gum contained, which is most abundant in the heart-wood.

The Bahama lignum-vitæ has a very large proportion of sap-wood, pieces of 8 or 10 inches diameter have heart-wood that scarcely exceeds 1 or 2 inches diameter. A variety of cocoa-wood and almond-wood are somewhat similar to lignum-vitæ.

There are two species, *Guaiacum officinale* and *G. sanctum*, both of which probably yield the lignum-vitæ of commerce. This name is also sometimes applied to the wood of *Arbor vitæ.*

LIME-TREE, called also the Linden-tree, *Tilia*, is common to Europe, and attains considerable size. The wood is very light-coloured, fine and close in the grain, and when properly seasoned, it is not liable to split or warp. It is nearly or quite as soft as deal, and is used in the construction of piano-

LIME-TREE—*continued.*

fortes, harps, and other musical instruments, and for the cutting-boards for curriers, shoemakers, &c. as it does not draw or bias the knife in any direction of the grain, or injure its edge: it turns very cleanly; this wood has recently been used for the frames of the best japanned chairs inlaid with mother-of-pearl, &c. Lime-tree is particularly suitable for carving, from its even texture and freedom from knots: the works of Gibbons, at Windsor Castle and St. Paul's, London, are of lime-tree; which wood, as well as box-wood, was eulogized by Virgil, Georgics, book ii. ver. 449.

The lime-tree, *Tilia europea,* is usually divided into several species; as *T. intermedia, microphylla, rubra,* and *platyphylla.*

LOCUST-TREE. The locust-tree of North America is *Robinia pseudacacia.* The wood is greenish-yellow, with a slight tinge of red in the pores; it is used like oak. Locust is much esteemed for tree-nails for ships, and for posts, stakes, pales, &c., as it is very tough and durable; it works similarly to ash, and is very good for turning.

"It grows most abundantly in the Southern States; but it is pretty generally diffused throughout the whole country. It sometimes exceeds four feet in diameter and seventy feet in height. The locust is one of the very few trees planted by the Americans."

"According to Mr. Browne, there are no less than 140 species of forest trees indigenous to the United States which exceed thirty feet in height. In France there are about thirty, and in Great Britain nearly the same number."—*Stevenson, Civil Engineering of North America,* p 183.

* The locust-tree of the West Indies and Guiana is *Hymenea Courbaril,* (Semiri,) a tree from 60 to 80 feet in height, and 5 or 6 feet in diameter: the colour of the wood of West India locust-tree is light reddish brown, with darker veins, and the mean size 36 inches. The wood in its native country is used for mill rollers and cogs of wheels. Another tree called Honey Locust, *Gleditschia triacanthus,* of which the wood splits with great ease, is coarse-grained, and but little used.

LOGWOOD, called also Campeachy logwood, is from the bay of that name, and from Jamaica, Honduras, &c. It is scarcely used for turning: it is a dark purple red dyewood, that is consumed in large quantities: its botanical name is *Hæmatoxylon campechianum.*

MAHOGANY, the *Swietenia Mahogoni,* is a native of the West Indies and the country round the Bay of Honduras. It is said to be of rapid growth, and so large that its trunk often exceeds 40 feet in length and 6 feet in diam. This wood was first brought to London in the year 1724; its Spanish name is *Caôba.*

SPANISH Mahogany is imported from Cuba, Jamaica, Hispaniola, St. Domingo, and some other of the West India islands, and the Spanish Main, in logs from about 20 to 26 in. square, and 10 ft. long. It is close-grained, hard, sometimes strongly figured, and generally of a darker colour than

MAHOGANY—*continued.*

Honduras; but its pores frequently appear as if chalk had been rubbed into them.

HONDURAS Mahogany is imported in logs of larger size than the above, that is, from 2 to 4 ft. square, and 12 to 18 ft. in length: sometimes planks have been obtained 6 or 7 ft. wide. Honduras mahogany is generally lighter than the Spanish, and also more open and irregular in the grain: many of the pieces are of a fine golden colour with showy veins and figures. The worst kinds are those the most filled with grey specks, from which the Spanish mahogany, (except the Cuba,) is comparatively free.

Specimens of the leaves, and of the handsome seed-vessels of the mahogany tree, are in Sir W. Symonds's museum.

Both Spanish and Honduras mahogany are supposed to be produced by the same tree, *Swietenia Mahogoni* of botanists, but some suppose that the Honduras is the wood of a different species, (V. Don, Syst. 1. p. 688,) but Long, in his History of Jamaica, says, "What grows on rocky grounds is of small diameter but of closer grain, heavier weight, and more beautifully veined; what is produced in low rich and moist land is larger in dimensions, more light and porous, and of a pale complexion. This constitutes the difference between the Jamaica wood and that which is collected from the coast of Cuba and the Spanish Main; the former is mostly found on rocky eminences, the latter is cut in swampy soils near the sea-coast."

AFRICAN Mahogany, (*Swietenia senegalensis,*) from Gambia, is a more recent importation; it twists much more than either of the above, and is decidedly inferior to them in all respects except hardness. It is a good wood for mangles, curriers' tables, and other uses where a hard and cheap wood of great size is required: it admits of being turned equally as well as the others.

African mahogany is the wood of *Khaya senegalensis*, a genus very closely allied to the Swietenia.

Mahogany shrinks but little in drying, and twists and warps less than any other wood; on which account it is used for founders' patterns, and other works in which permanence of form is of primary importance. For the same reason, and from its comparative size, abundance, soundness, and beauty, it is the most useful of the furniture woods, and it holds the glue the best of all. Mahogany is also used for a variety of turned works, apart from upholstery and cabinet-work. The Spanish mahogany is in general by far the best, although some of the Honduras nearly approaches it, except in hardness and weight. The African is by no means so useful or valuable as either of the above, as it alters very much in drying.

There are two other species of *Swietenia*, besides the Mahogany tree, which are natives of the East Indies: the one, a large tree of which the wood is of a dull red colour, and remarkably hard and heavy; the other is only a middle-sized tree, the wood of which is close-grained, heavy and durable, of a deep yellow colour, and much resembles boxwood; but neither of these species is in common use in this country.—*Tredgold.*

The first of these trees was formerly referred to Swietenia, but is now *Soymida febrifuga*, the second is probably *Chloroxylon Swietenia*, which is the Satin-wood of India and Ceylon. A third species much admired for its light colour, close grain, and being elegantly veined, is the *Chikrassee* of the natives, and *Chikrassia tabularis* of botanists: the wood is much employed in making furniture and cabinet-work. The wood of the Toon-tree, *Cedrela Toona*, is sometimes called Indian Mahogany.

MANCHINEEL, a large tree of the West Indies and South America; the wood possesses some of the general characters of mahogany and is similarly used, but it is much less common. The wood is described as yellow brown, beautifully clouded, and very close, hard and durable. It is said the Indians poison their arrows with its juice, and that the wood-cutters make a fire around it before felling it, to cause the injurious sap to run out, to avoid injuring their eyes.

This has been accurately described in Bancroft's Guiana, p. 36-7, and Colonel Lloyd says of it: "The juice of this tree is a most deadly poison; it bears a little apple appearing so like the English fruit, and so tempting, that many new-comers have been poisoned by eating it. The tree is poisonous while green; sleeping under it has the most deadly effect, and I have myself been blistered most severely by passing under one in a shower of rain, when some of the drops have fallen on me; its effects are like molten lead."

Hippomane Mancinella, is the Manchineel-tree of the West Indies. *Cameraria latifolia* is called bastard Manchineel.

MANGROVE. Natives of the shores of the tropics, bearing this name, and those of Mango, Mangle, *Maniglier* (Fr.) &c., differ very much in kind: some that I have examined bear the appearance of very indifferent ash and elm, others of good useful woods of the same kind, some are dark coloured, and many of them have the red mahogany character.

One of the latter kind known to our cabinet-makers, has less of the brown and more of the red tint than mahogany, it becomes darker on exposure, but not in general so much so as mahogany. This Mangrove is straight-grained, hard, and elastic, and stands almost better than Spanish mahogany, and it is, therefore, preferred for straight edges and squares, &c.

A specimen in Mr. Loddiges's collection, named *Rhizophora decandra*, and another, *Mangle vermelho*, both from Rio Janeiro, much resembled the beautiful wood last described, as likewise the *Savacoa* (*see* Acacia), although in grain it is somewhat coarser.

"The timbers are very much valued for ship-building, and a large quantity comes from Crab Island and Porto Rico."—*Col. Lloyd.*

The mangrove-tree is *Rhizophora Mangle*, of which the wood is employed in making staves for sugar-hogsheads. Growing in the same situations with it are two trees to which the name mangrove is also applied: the *Conocarpus racemosa*, is called white mangrove by Sloane, and *Avicennia tomentosa*, olive mangrove. *Coceoloba uvifera*, sea-side grape, also grows in the same situations, and is a large tree of which the wood is of a reddish colour.

MAPLE, is considered to be allied to the Sycamore, which is sometimes called the great maple, (*Acer Pseudo-platanus*,) or the plane-tree. The English, or common maple, is of this kind; its colour is pale yellow brown, and it is only used for ordinary Tunbridge-ware, such as boxes, butter prints, &c.

The American, especially that from Prince Edward's Island, is very beautiful, and distinguished as bird's-eye maple and mottled maple. The latter is principally used for picture-frames; the former is full of small knots that give rise to its name: the grain varies according as the saw

MAPLE—*continued.*

divides the eyes transversely or longitudinally, as pieces cut out in circular sweeps, such as chair backs, sometimes exhibit both the bird's eye and mottled figures at different parts. Much sugar is made in America from this variety of maple. The common maple, (*Acer campestris,*) is very much used in America for house-carpentry and furniture.

The so-called Russian maple is considered to be the wood of the birch-tree ; it is marked in a manner similar to the American maple, but is unlike it, inasmuch as there are little stripes that appear to connect the eyes, which in the American are quite distinct, and arise from a different cause, which is explained at page 38. All but the first are much used in handsome cabinet-work, and their diversities of grain are very beautifully shown in turned works. Some of the Russian birch is beautifully yellow.

Acer campestre is the common maple, and *A. platanoides* the platanus-like or Norway maple, while *A. pseudo-platanus* is the great maple, sycamore, or mock plane-tree. *A. saccharinum* is the sugar maple, and its wood is often called bird's-eye maple. *A. rubrum, circinatum, striatum,* and *eriocarpum,* are other American species of which the timber is employed and more or less valued. *Acer oblongum, cultratum, caudatum, sterculiaceum* and *villosum*, are Himalayan species of which the timbers may be employed for the same purposes.

MARACAYBO is a furniture wood of moderate size, as hard as good mahogany, and in appearance between it and tulip-wood. It is sometimes called Maracaybo cedar, but it has no resemblance to the cedar, although it may grow in the vicinity of the Bay of Maracaybo. A wood in Mr. Morney's collection from Rio Janeiro, marked *Maracauba*, is similar to the above.

MEDLAR-TREE, (*Mespilus germanica,*) the wood is white, soft, and being small is not much used, except for walking-sticks.

MICOCOULIER. *See* NETTLE-TREE.

* MORA-WOOD. Specimens of the Mora-tree were brought home by Mr. Schomburgk, and have been described by Mr. Bentham under the head *Mora excelsa ;* the tree is 100 feet high and abundant ; the wood is close-grained like teak, and superior to oak, esteemed for ship-building, and likewise fitted for knees from the branches growing crooked ; in colour it resembles moderately red mahogany.

MOSATAHIBA. *See* MUSTAIBA.

MULBERRY-TREE, (*Morus,*) consists of about twenty varieties, of which the yellow fustic is one that is imported in considerable quantities from Rio de Janeiro. Bergeron very strongly recommends the white mulberry, which he describes as similar to elm, but very close in the grain, and suitable for furniture. He says the white is greatly superior to the black mulberry.

Morus nigra is the black, and *Morus alba* the white mulberry ; there are several other species of which the wood is esteemed for its toughness, as of *Morus parvifolia* in India, for hardness and tenacity. *See* FUSTIC.

MUSTAIBA, from the Brazils and Rio Janeiro, is imported in logs 7 by 10 in., and also in planks ; it is generally of an inferior rosewood character but harder, and is sometimes equally good ; the veins are of a chesnut brown, running into black. In its grain it resembles some of the iron-woods, and

MUSTAIBA—*continued.*

black partridge-wood; it has fewer resinous veins than the rose-woods. Mosatahiba, as well as lignum-vitæ, cocoa-wood, &c., is used at Sheffield for the handles of glaziers' and other knives; some of the better kinds are very good for turning, as the wood is close, sound, and heavy.

I have copied the Portuguese name for this wood from Mr. Morney's and Mr. ———'s specimens in Sir W. Symonds's collection; it is known in England as Mosatahiba.

NETTLE-TREE, (*Celtis australis,*) *Micocoulier* of the French, has wood that is compact, between oak and box for density, and takes a high polish; it is described in the French works as a heavy, dark, close wood, without bark, very durable and free from flaws. It is said to be used for flutes, &c., and for carving; it is also called *bois de Perpignan.*

NICARAGUA-WOOD, a native of South America, is imported from the bay of Nicaragua, and also from St. Lucia, Rio de la Hache, Mexico, &c. in rough groovy logs without sap, that measure from 2 to 9 inches through, and 2 to 3 feet long.

Another sort, from Lima, Jamaica and Peru, called by the dyers Peach-wood, apparently from the colour for which it is used, is shipped in logs sometimes as large as 18 in. diam. and 6 ft. long. Both are similar to Brazil-wood in colour, and generally too unsound for turning.

The trees yielding Nicaragua and Peach woods have not been yet ascertained, but have been supposed to be species of *Cæsalpinia*, or of *Hæmatoxylon*, but they may be very distinct, as coloured woods belong to other genera.

NUTMEG-WOOD. *See* Palm.

OAK, (*Quercus*). Of this valuable timber there are two kinds common to England, and several others to the Continent and America. Oak of good quality is more durable than any other wood that attains the same size; its colour is a well-known brown. Oak is a most valuable wood for ship-building, carpentry, frames, and works requiring great strength or exposure to the weather; also for the staves of casks, spokes of wheels generally, and the naves of waggon-wheels, for tree-nails, and numerous small works, &c. The red varieties are inferior, and are only employed for ornamental furniture.

The English oak is one of the hardest of the species; it is considerably harder than the American, called white and red Canada oak, or than the wainscot oak from Memel, Dantzic, and Riga; the latter, which are the more interspersed with the ornamental markings or flower from the septa or medullary rays in the wood, are the least suitable as timber.

The wainscot oak of Norway is remarkably straight, and splits easily; so much so, that it is the practice of the country to bore a small hole in the top of the tree at the beginning of the winter, and to fill it with water, the expansion of which in freezing rends the tree from top to bottom.

Considerable quantities of oak are imported from Italy, Istria and Styria, and they are considered to be of good growth and perhaps equal to the English in quality; they are used in our Government dock-yards.

OAK—*continued.*

The Live Oak is a fine tree, that is met with in the Southern States of North America; it is very different in appearance from the others, as the veins are small, and more evenly distributed throughout the wood: it is used in America, along with the North American red cedar, for their finest ships; it is considered to be durable when dry, but not when exposed to wet.

" The sea air seems essential to its existence, for it is rarely found in the forests upon the mainland, and never more than 15 or 20 miles from the shore." " The live oak is commonly 40 or 50 feet in height, and from 1 to 2 feet in diameter, but it is sometimes much larger."—*Stephenson's Engineering of North America,* p. 181.

There is also a fine evergreen oak in the Cordilleras of the Andes.

An Asiatic Oak, *Quercus Amherstiana,* (No. 341, Dr. Wallich's collection,) from Martaban, appears to be a fine dense wood, and as dark as our black walnut.

The African Oak is well adapted to the construction of merchant-vessels, but it is apt to splinter when struck by shot, it is therefore less used for ships of war. They are all softened by steaming, and are then much more easily cut or bent; the African bends less than the others, and is the darkest in colour, but it has not the silver grain nor the variegated appearance of the others, it is sometimes called Teak (which see).

Of the British Oak there are two distinct species according to modern botanists. The *Quercus Robur,* sometimes called *pedunculata,* has acorns which are supported on long footstalks or peduncles; this timber is considered by some superior to that of the other species *Q. sessiliflora,* but this probably depends on situation, as the strength and toughness of this kind, as well as its durability, have been proved to be great. Dr. Lindley says its wood may be known by its medullary rays or silver grain being so far apart that it cannot be rent, and this gives it quite a peculiar aspect.

Quercus Ilex, the evergreen or holm Oak, is common to the South of Europe; the wood is hard, heavy and tough. *Q. Suber* is the cork-tree. *Q. Cerris,* called the Turkey Oak, is common in the south-east of Europe; its timber is ornamental, being beautifully mottled, in consequence of the abundance of its silvery grain, and is supposed to be often as good as any other; the Sardinian oak is apparently produced by it. The Wainscot Oak is supposed by some to be produced by *Q. Cerris.* Dr. Lindley considers it to be a variety of *Q. sessiliflora,* grown fast in rich oak land. *Q. hispanica,* the Spanish oak, and *Q. austriaca,* the Austrian oak, are found in the countries from which they are named; and *Q. Ægilops* is the Valonia oak, abounding in Greece and Asia Minor, from which such large quantities of its acorns are imported into England. *Q. crinita* is common in Asia Minor, yields excellent timber, and is employed by the Turks in naval architecture.

The American Oaks are numerous, but the timber of *Quercus alba,* or the white oak, comes nearest to the English oak, and is largely exported to England as well as to the West Indies. *Q. virens,* the live oak, is confined to the southern of the United States, and is also found in Texas; it is said to yield the best oak in America, the timber being heavy, compact, and fine grained.

Q. tinctoria. dyers' or black oak, is best known from its inner bark being used as a yellow dye, under the name of Quercitron; its wood is strong but coarse. The other American oaks are inferior in the quality of their timber. Besides these there are Indian and Himalayan oaks: the timber of some of the latter is excellent in quality.

The African Oak, or Teak as it is also called, is not a species of *Quercus,* V. Teak.

OLIVE-WOOD, principally imported from Leghorn, is the wood of the fruit-tree (*Olea europea*); it is much like box, but softer, with darker grey-coloured veins. The roots have a very pretty knotted and curly character; they are much esteemed on the Continent for making embossed boxes, pressed into engraved metallic moulds.

OLIVE-WOOD—*continued.*

There is another wood, apparently from South America, called Olive-wood, but it does not agree in colour, either with the fruit or wood of the olive-tree, but is of a greenish orange, with broad stripes and marks of a darker brown tint; it is a handsome wood for turning, but not very hard.

Elæodendron glaucum is called *bois d'olive*, but there is no proof that it yields the olive wood alluded to, as the country from which this is imported is not distinctly known.

OMANDER. *See* COROMANDEL.

ORANGE-TREE. The orange, lemon and lime trees, *(Citrus,)* are evergreens that seldom exceed about 15 feet in height. The wood is only met with as an object of curiosity: it is of a yellow colour, but devoid of smell. *See* APRICOT-TREE.

The orange is *Citrus Aurantium*, the lemon *C. Limonum*, the lime *C. Limetta*, and the citron *C. Medica.*

PALM-TREES. Two or three varieties only, of the four or five hundred which are said to exist, are imported into this country from the East and West Indies: they are known in England by the names, palm, palmetto, palmyra, and nutmeg, leopard, and porcupine wood, &c., from their fancied resemblances, as when they are cut horizontally, they exhibit dots like the spice, and when obliquely, the markings assimilate to the quills of the porcupine.

The trunks of the palms are not considered by physiological botanists to be true wood; they all grow from within, and are always soft and spongy in the center, but are gradually harder towards the outside: they do not possess the medullary rays of the proper woods, but only the vertical fibres, which are held together by a much softer substance, like *pith* or cement, so that the horizontal section is always dotted, by which they may be readily distinguished from all true woods. The colours and hardness of the two parts differ very materially, and I am enabled, through the kindness of Sir James Sutherland, and Colonel Sykes, to give the distinctive names of three to which I shall advert.

The *Areca Catechu*, or betel-nut palm, is remarkably perpendicular; it grows to the height of about 30 feet, and rarely exceeds 4 or 5 in. diam. it bears a small tuft of leaves, and the fruit is in clusters like grapes. The betle-nut is chewed by the Indians along with quicklime, and the leaf of the Piper Betle, in the manner of tobacco. The general colour of the wood is a light yellow brown; the fibres are large, hard, and only a few shades darker than the cementitious portions.

The *Cocos nucifera*, or cocoa-nut palm, flourishes the best in sandy spots near the sea-beach; it sometimes grows to 90 ft. in height and 3 ft. in diam., but is generally less; it is rarely quite straight or perpendicular, and has broad pendent leaves from 12 to 14 feet long, in the midst of which is a sort of cabbage, which, as well as the fruit, the cocoa-nut, is eaten, the husk of the nut supplies the material for coir-rope, &c. No part of this interesting tree is without its grateful service to the Indian: the leaves are used for

PALM-TREES—*continued.*

making baskets, mats, and the covering of his dwelling; he also obtains from this tree, oil, sugar, palm-wine and arrack; and although the upper part of the trunk is soft and stringy, the lower supplies a useful wood, the fibres of which are of a chesnut brown, and several shades darker than the intermediate substance; the wood is employed for joists, troughs for water, and many purposes of general carpentry, &c. The Asiatic Society has specimens marked, male, 1st, 2nd, 3rd, 4th sorts, and the same number of female varieties; no marked distinction is observable between them.

The *Niepere* palm is much darker than either of the preceding kinds; the fibres are nearly black and quite straight, and the cement is of a dark brown; but in other varieties with these black fibres, the softer part is very light-coloured, and so friable that it may be picked out with the fingers; Colonel J. A. Lloyd informs me, that at the Isthmus of Darien, they use the fibres of some of the palms as nails for joinery-work.

Palmyra-wood, or that of *Borassus flabelliformis,* says Mr. Laird, is largely imported into Madras and Pondicherry, from the Jaffna district at the northern part of Ceylon, for the construction of flat roofs; the joists of which consist of two slabs, the third or fourth part of the tree, bolted together by their flat sides so as to constitute elliptical rafters. They are covered first with flat tiles, and then with a white concrete called *Chunam,* consisting of shell lime, yolks of eggs, and *Jaggree,* (sugar,) beaten together with water in which the husks of the cocoa-nuts have been steeped.

The prickly pole (*Cocos guianensis*) of Jamaica, &c. a palm growing 40 feet high, and of small diameter, is said to be very elastic, and fit for bows and rammers.—*Capt. Symonds.*

The palm woods are sparingly employed in England, for cabinet and marquetry work, and sometimes for billiard cues, which are considered to stand remarkably well; they are also turned into snuff-boxes, &c. The smaller kinds are imported under the names of Partridge canes, (called also Chinese or fishing canes,) Penang canes from the island of that name, and some others, for walking-sticks, the roots serving to form the knobs or handles. The knobs of these sticks exhibit irregular dots something like the scales of snakes, these arise from the small roots proceeding from the principal stem, which latter shows dotted fibres at each end of the stick, and streaks along the side of the same.

The *twisted* palm sticks, are the central stems or midribs of the leaves of the date palm; they are twisted when green, and stretched with heavy weights until they are thoroughly dry: they are imported from the Neapolitan coast, but are considered to be produced in Egypt.

The bamboos, which, like the palms, are endogens, are used in India and China for almost every purpose in the arts; amongst others, in working iron and steel, the bamboo is preferred as fuel, the large pieces serve as the blowing cylinders, the small as the blast-pipe, and, together with a cocoa-nut shell, for the *hookah* of the artisan. In England the bamboos, and several

PALM-TREES—*continued.*

of the solid canes, are used as walking-sticks, and for umbrella and parasol sticks, &c.

The shells of the cocoa-nut and coquilla-nut, and the kernels of the areca or betle-nut, and of the corosos or ivory-nut, have likewise their uses in our workshops. *See* SUPPLEMENT, following letter Z, of this Catalogue.

PALISANDER, a name used on the Continent for rosewood.

There is considerable irregularity in the employment of this name; in the work of Bergeron a kind of striped ebony is figured as *bois de Palixandre*, in other French works this name is considered a synonym of *bois violet*, and stated as a wood brought by the Dutch from their South American colonies, and much esteemed.

PARTRIDGE-WOOD, is the produce of the Brazils, and the West Indian Islands; it is sent in large planks, or in round and square logs, called from their tints red, brown, and black, and also sweet partridge; the wood is close, heavy, and generally straight in the grain. The colours are variously mingled, and most frequently disposed in fine hair-streaks of two or three shades, which in some of the curly specimens cut plankways resemble the feathers of the bird; other varieties are called pheasant-wood. The partridge-woods are porous, cut horizontally, the annual rings appear almost as two distinct layers, the one hard woody fibre, the other a much softer substance thickly interspersed with pores: this circumstance gives rise to its peculiar figure, which often resembles that of the palm-tree woods.

Partridge-wood was formerly employed in the Brazils for ship-building; and it is also known in our dock-yards as Cabbage-wood: the red-coloured variety is called *Angelim* and *Cangelim* in the Brazils, and *Yava* in Cuba: a specimen in one of the collections at the Admiralty is marked "Bastard Cabbage-wood," *Andira inermis.*

It is now principally used for walking-sticks, umbrella and parasol sticks, and in cabinet-work and turning; the ladies have patronised it also for fans.

The partridge-wood imported from the West Indies is yielded by *Heisteria coccinea.* The wood of several trees is no doubt included under this name.

PEACH-WOOD. *See* NICARAGUA-WOOD.

PEAR-TREE, *(Pyrus communis,)* is a native of Europe. The wild trees are principally used, and they may be obtained from 7 to 14 in. diam. The colour is a light brown, approaching pale mahogany or cedar, generally less red than the apple-tree.

It is one of the brown woods of the Tunbridge-turner, by whom it is much used; and it is esteemed a very good wood for carving, as it cuts with nearly equal facility in all directions of the grain, and many of the old works are cut in it. It is now much used for the engraved blocks for calico-printers, paper-stainers, and pastry-cooks; it does not stand very well, unless it is exceedingly well seasoned.

Some pieces of pear-tree much resemble lime-tree from being, in the language of the workmen, "without grain," but the pear-tree is harder and tougher, and has a few darker streaks: they are used however for similar purposes.

PERNAMBOUCA. *See* BRAZIL-WOOD.

PERUVIAN-WOOD, a fine sound wood so called, is of the rose-wood character, and measures about 12 to 16 inches through; it is harder, closer, and lighter in colour than rosewood; it has no smell, and a straighter distribution of its dark red-brown and black veins. Its true name and locality are unknown.

PIGEON-WOOD. Mr. Loddiges' specimen is of the colour of walnut-tree, with blackish cloudy marks; another from Jamaica, at the Society of Arts, is of a brown orange colour; the latter is the more general tint of the woods thus named. *See* ZEBRA-WOOD.

PINES and FIRS, (*Pinus,*) constitute a very numerous family of cone-bearing timber-trees, that thrive the best in cold countries. The woods differ somewhat in colour, partly from the greater or less quantity of resinous matter or turpentine contained in their pores, which gives rise to their popular distinctions, red or yellow, and white firs or deals, and the red yellow and white, spruce, or pitch pines, and larches. They are further distinguished by the countries in which they grow, or the ports from whence they are shipped, as, Norway, Baltic, Memel, Riga, Dantzic, and American timber; Swiss deal; &c.

The general characters of the wood, and its innumerable uses besides those of ship and house carpentry, are too generally known to call for any description in this place; but those who may require it will find abundant information in Tredgold's Carpentry, pages 208 to 218. The Swiss deals, imported under the name *Belly-boards,* are used for the sounding-boards of musical instruments. The larch is particularly durable, from the quantity of turpentine it contains; it has of late been considerably employed in Her Majesty's dockyards for naval architecture, as likewise the Hackmetack larch: it is considered the best wood for the sleepers of railways; its bark is also used for tanning. "The American pitch-pine is likewise exceedingly durable, and is much used in the West Indies, &c., for flooring, as it is free from the attacks of the white ant." The white hemlock, from St. John's, New Brunswick, Halifax, contains very little turpentine, and is remarkably free from knots: it is sometimes imported from 2 to 3 feet square, and 60 to 70 feet long, and is suitable for piling the staves of dry casks, &c.; it stands extremely well.

The Cowdie, Kaurie, or New Zealand Pine, or *Dammara australis,* is the most magnificent of the coniferous woods, although not a true pine. It is said to grow from 4 to 12 feet diameter; one that had been blown down by the wind was found by Brown to measure upwards of 170 feet. The Norfolk Island pine, *Araucaria excelsa,* has enormous knots, which were noticed at page 37.

In Norway, when they desire to procure a hard timber with an overdose of turpentine, they ring the bark of the branches just before the return of the sap; the next year they ring the upper part of the stem; the third

PINES and FIRS—*continued.*

year the central, and lastly, the lower part near the ground. By these means the sap or turpentine is progressively hindered from returning, and it very much increases the solidity and durability of the timber. The roots of some of the red deals so abound in turpentine, that the Scottish Highlanders, the natives of the West Indies, and of the Himalayas, are said to use splinters of it as candles. The knots of deal, especially white deal, are particularly hard ; they are altogether detached from the wood in the outer planks, and often fall out when exposed in thin boards.

The pines and firs being so numerous, and the timbers of many being known in commerce by such a variety of names, it is difficult to ascertain the trees which yield them.

The *Pinus sylvestris*, however, called the *wild pine*, or *Scotch fir*, yields the red deal of Riga, called yellow deal in London ; *Abies excelsa*, or Norway spruce fir, yields white deal, *Abies picea*, or silver-fir, has whitish wood, much used for flooring ; *Larix europea*, is the larch common on the Alpine districts of Germany, Switzerland, and Italy. Several other pines, as *P. Pinaster*, *Pinea*, *Cembra*, *austriaca* and *pyrenaica*, are found in the south of Europe, but their timber is less known in commerce.

The North American pines, *P. strobus*, or Weymouth pine, called white pine in North America, and much used throughout the northern states ; *P. mitis*, or *lutea*, the yellow pine, is chiefly employed in the northern and middle states for house and ship-building ; it is considered next in durability to *P. australis*, Southern pine, called also *P. palustris*, and yellow pine, pitch pine, and red pine in different districts : it is said to form four-fifths of the houses in the Southern States, and to be preferred for naval architecture. Its timber is exported to the West Indies and to Liverpool, where it is called Georgia pitch-pine. *Pinus tæda*, frankincense pine, called white pine in Virginia ; *P. rigida*, Virginian or pitch pine ; *P. banksiana*, Hudson's Bay or Labrador pine ; *P. inops*, Jersey or poor pine, and *P. resinosa*. The American pitch pine or red pine, called Norway pine in Canada, and yellow pine in Nova Scotia, and many others, yield deals of various qualities, more or less used in different districts.

The American spruce firs are the *Abies alba*, *nigra* and *rubra*, the white, black, and red spruce firs ; the last is sometimes called Newfoundland red pine, and employed in ship-building ; both it and the black pine are exported to England ; *Abies canadensis*, hemlock spruce fir and *A. balsamea*, balm of Gilead fir, are also employed, although less valued for their timber, but the American larch, *Larix americana*, is much esteemed. On the west coast of America some magnificent pines have been discovered, as *P. Douglasii*, and *Lambertiana*, and others in Mexico. In the southern hemisphere the Cowdie pine or New Zealand pitch tree, *Dammara australis*, considered so valuable for masts, belongs to the same genus as the *Dammar* tree, *D. Orientalis*. The Himalayas abound in true pines : a splendid species is the *Pinus Deodara* already mentioned under Cedar, so also are *Pinus excelsa*, *Khutrow longifolia*, with *Abies Webbiana*, *Pindrow*, and others.

PLANE-TREE, (the *Platanus occidentalis,)* is a native of North America ; it is abundant on the banks of the Mississipi and Ohio. This, perhaps one of the largest of the American trees, is sometimes 12 ft. diam. ; it is much used in that country for quays. The colour of the wood resembles beech, but it is softer. In Stephenson's Civil Engineering of North America, this is called Butterwood-tree, and he gives the dimensions of some, measured by Michaux, fully equal to the measure quoted. The American variety, which is that more commonly grown in England, is sometimes called water-beech and sycamore. Plane-tree is used for musical instruments and other works requiring a clean light-coloured wood.

The *Platanus orientalis*, called also lace-wood, is a native of the Levant, and other Eastern countries ; it is smaller, softer, and more ornamental than the above ; the beauty of its septa gives it the damasked appearance from which it is sometimes named. It is commonly used by the Persians for

PLANE-TREE—*continued.*

their doors, windows, and furniture; it is suitable to ornamental cabinet-work and various kinds of turnery. The first kind also has the septa, but they are smaller.

The true lace-wood tree is the *Daphne Lagetta.*

PLUM-TREE, (*Prunus domestica* and *P. spinosa,*) Europe, is similar in general character to pear-tree; used principally in turning. This is a handsome wood, and it is frequently used in Tunbridge works: in the endway of the grain it resembles cherry-tree, but the old trees are of a more reddish-brown, with darker marks of the same colour. It begins to rot in small holes more generally away from, rather than in the center of the tree, and it is very wasteful on that account.

POON-WOOD, or Peon-wood, of Singapore, is of light porous texture, and a light-greyish cedar colour; it is used in ship-building for planks, and makes excellent spars. The Calcutta poon is preferred.

Calophyllum inophyllum is called Poona in the peninsula of India, and *C. angustifolium,* Dr. Roxburgh says, is a native of Penang and of countries eastward of the Bay of Bengal, and that it yields the straight spars commonly called Poon, and which in these countries are used for the masts of ships.

PRINCES-WOOD, from Jamaica, is generally sent in logs like cocoa-wood, from 4 to 7 in. diam. and 4 to 5 ft. long; it is a light veined wood, something like West India satin-wood, but of a browner cast; the sap-wood resembles dark birch-wood. It is principally used for turning.

The Princes-wood of Jamaica, called also Spanish Elm, is *Cordia Gerascanthus,* but the above appears to be different.

POPLAR (*Populus*). There are five species common to England, of which the Abele, or great white poplar, and the Lombardy poplar, are the most used. The woods are soft, light, easy to work, suited to carving, common turnery and works not exposed to much wear; are sometimes used in temporary railway works, but not for the ordinary purposes of timber. It is considered to be very durable when kept dry, and it does not readily take fire. The bark of the white poplar is almost as light as cork, and is used by the fisherman to support his nets.

The wooden polishing wheels of the glass-grinder are made out of horizontal slices of the entire stem, about one inch thick, as from its softness it readily imbibes the polishing materials.

The wood of the *Abele,* or white poplar, is also commonly known as Aps; it is extensively used for toys and common turnery, and is frequently of a uniform reddish colour, like red deal, but with very small veins.

Populus alba is the white poplar or Abele, *P. canescens* the gray or common white, *P. tremula* is the aspen, and *P. pyramidalis* or *fastigiata,* the Lombardy poplar. There are other species in North America and the Himalayas.

PRIZE-WOOD. A large ill-defined wood, from the Brazils, I believe of the cocus-wood kind, but lighter, and generally of reddish colour.

PURPLE-HEART, is mentioned by Dr. Bancroft, (*see* Greenheart;) it is perhaps the more proper name for the wood next described.

PURPLE-WOOD, or Amaranthus, from the Brazils, is imported in logs from 8 to 12 in. sq. and 8 to 10 ft. long, or in planks: its colour is dark grey when first cut, but it changes rapidly, and ultimately becomes a dark purple.

Varieties of King-wood are sometimes called purple and violet woods: these are variegated; but the true purple-wood is plain, and principally used for ramrods, and occasionally for buhl-work, marquetry, and turning. A few logs of purple-wood are often found in importations of King-wood; it is probable also that the purple-heart is thus named occasionally.

QUASSIA-WOOD. The quassia-tree is a beautiful tall tree, of North and South America and the West Indies. The wood is of a pale yellow, or light-brown, and about as hard as beech; its taste is intensely bitter, but the smell is very agreeable; the wood, bark, and fruit are all medicinal.

"This wood is well known in the Isthmus of Darien, and is invariably carried by all the natives as a 'contra' against the bite of venomous snakes: it is chewed in small slices, and the juice is swallowed."—*L.*

Quassia amara, is a small tree, *Simaruba amara* is the Mountain damson of the West Indies, and *Picræna excelsa*, the lofty Bitter-wood. All have a similarly-coloured wood, which is intensely bitter.

QUEEN-WOOD, from the Brazils, a term applied occasionally to woods of the Greenheart and Cocoa-wood character.

QUINCE-TREE, (*Cydonia vulgaris.*) *See* APRICOT-TREE.

RED GUM-WOOD. *See* GUM-WOOD.

RED SAUNDERS, or **RUBY WOOD**, an East Indian wood, the produce of *Pterocarpus santalinus*, is principally shipped from Calcutta in logs from 2 to 10 in. diam., generally without sap, and sometimes in roots and split pieces; it is very hard and heavy; it is very much used as a red dye-wood, and often for turning. The logs are often notched at both ends, or cut with a hole as for a rope, and much worn externally as from being dragged along the ground; other woods, and also the ivory tusks, are sometimes perforated for the like purpose.

The wood of *Adenanthera pavonina*, (see Coral-wood,) is similar in nature, and sometimes confounded with the red saunders.

ROSETTA-WOOD, is a good sized East Indian wood, imported in logs 9 to 14 in. diam.; it is handsomely veined; the general colour is a lively red-orange, (like the skin of the Malta orange,) with darker marks, which are sometimes nearly black; the wood is close, hard, and very beautiful when first cut, but it soon gets darker.

ROSE-WOOD, is produced in the Brazils, the Canary Isles, the East Indies, and Africa. It is imported in very large slabs, or the halves of trees that average 18 inches wide. The best is from Rio de Janeiro, the second quality from Bahia, and the commonest from the East Indies: the latter is called East India black-wood, although it happens to be the lightest and most red of the three; it is devoid of the powerful smell of the true rose-wood, which latter Dr. Lindley considers to be a species of Mimosa. The pores of the latter appear to contain less or none of the resinous

ROSE-WOOD—*continued.*

matter in which the odour, resembling that of the flower *Acacia armata*, may arise. Rose-wood contains so much gum and oil, that small splinters make excellent matches for lighting candles.

The colours of rose-wood are from light hazel to deep purple, or nearly black: the tints are sometimes abruptly contrasted; at others, striped or nearly uniform. The wood is very heavy; some specimens are very close and fine in the grain, whereas others are as open as coarse mahogany, or rather are more abundant in veins: the black streaks are sometimes particularly hard, and very destructive to the tools.

Next to mahogany, it is the most abundant of the furniture woods; a large quantity is cut into veneers for upholstery and cabinet work, and solid pieces are used for the same purposes, and for a great variety of turned articles of ordinary consumption.

In the Brazils the ordinary rose-wood is called *Jacaranda Cabuna;* there is a sort which is much more free from resinous pores that is called *Cabuna* only, and a third variety, *Jacaranda Tam*, is of a pale red, with a few darker veins: it is closer, harder, and very free from resinous veins; its colours more resemble those of tulip-wood. There are six, if not ten, varieties in Mr. ——'s collection at the Admiralty.

Mr. Edwards says that at the time when rose-wood was first imported there was on the scale of Custom-House duties, "Lignum Rhodium, per ton, £40," the wood from which the "oil of Rhodium" was extracted, which at that time realized a very high price. The officers claimed the like duty on the furniture rose-wood; it was afterwards imported as Jacaranda, Palisander, and Palaxander-wood, by which names it is still called on the Continent. The duty is now reduced to six guineas, and its consumption has increased tenfold; it is now only known as rose-wood, some logs of which have produced as much as £150, when cut into veneers.

Rose-wood is a term as generally applied as iron-wood, and to as great a variety of plants in different countries, sometimes from the colour and sometimes from the smell of the woods. The rosewood which is imported in such large quantities from Bahia and Rio Janeiro, called also Jacaranda, is so named according to Prince Maximilian, as quoted by Dr. Lindley, because when fresh it has a faint but agreeable smell of roses, and is produced by a *Mimosa* in the forests of Brazil. Mr. G. Loddiges informs me it is the *Mimosa Jacaranda*.

The rosewood, or candle-wood, of the West Indies, is *Amyris balsamifera*, according to Browne, and is also called Sweet-wood, while *Amyris montana* is called Yellow candle-wood, or rosewood, and also yellow saunders. Other plants to which the name is also applied, are *Licaria guianensis* of Aublet, *Erythroxylum areolatum*, *Colliguaya odorifera*, Molina, &c.

The rosewood of New South Wales is *Trichilia glandulosa;* that of the East Indies, if the same as what is there called Blackwood, is *Dalbergia latifolia*.

The lignum rhodium of the ancients, from which the oil of the same name and having the odour of roses was prepared, has not yet been ascertained; it has been supposed to be the *Genista canariensis*, and by others *Convolvulus scoparius*.

RUBY-WOOD. *See* RED SAUNDERS.

SALLOW, (*Salix caprea*,) is white, with a pale-red cast, like red deal, but without the veins. The wood is soft and only used for very common works, such as children's toys: like willow, of which it is a variety, it is planed into chips, and made into bonnets and baskets; it splits well. *See* WILLOW.

SANDAL-WOOD, is the produce of *Santalum album*, a tree having somewhat the appearance of a large myrtle. The wood is extensively employed as a perfume in the funeral ceremonies of the Hindoos. The deeper the colour, which is of a yellow-brown, and the nearer the root, the better is the perfume. Malabar produces the finest sandal-wood; it is also found in Ceylon, and the South Sea Islands. It is imported in trimmed logs from 3 to 8 and rarely 14 in. diam., the wood is in general softer than boxwood, and easy to cut. It is used for parts of cabinets, necklaces, ornaments, fans, &c. The bark of the sandal-wood gives a most beautiful red or light claret-coloured dye, but it fades almost immediately when used as a simple infusion; in the hands of the experienced dyer it might, it is supposed, be very useful.

There are woods described in the French works as red sandal-woods, and one specimen is so marked in Baker's collection; probably they are varieties of red sanders or sapan woods. *See* CALEMBEG.

The sandal-wood tree of the Malabar coast is the *Santalum album*, that of the South Sea Islands is considered to be a distinct species, and has been named *Santalum Freycinetianum*; there is a spurious sandal-wood in the Sandwich Isles, called by the natives *Naihio* (*Myoporum tenuifolium*).

SAPAN-WOOD, or Buckum-wood, (*Cæsalpinia Sapan*,) is obtained from a species of the same genus that yields the Brazil-wood. It is a middle-sized tree, indigenous to Siam, Pegu, the coast of Coromandel, the Eastern Islands, &c. It is imported in pieces like Brazil-wood, to which, for the purposes of dyeing, it is greatly inferior; it is generally too unsound to be useful for turning.

SATIN-WOOD. The best variety is the West Indian, which is imported from St. Domingo, in square logs and planks from 9 to 20 in.; the next in quality is the East Indian, shipped from Singapore and Bombay in round logs from 9 to 30 in. diam.; and the most inferior is from New Providence, in square sticks from 3½ to 10 in.; the wood is close, not so hard as boxwood, but somewhat like it in colour or rather more orange; some pieces are very beautifully mottled and curled. It was much in vogue a few years back for internal decoration and furniture, it is now principally used for brushes, and somewhat for turning; the finest kinds are cut into veneers, which are then expensive: the Nassau wood is generally used for brushes. Satin-wood of handsome figure was formerly imported in large quantities from the island of Dominica. The wood has an agreeable scent, and is sometimes called yellow saunders. Bergeron mentions a "*bois satiné rouge*."

The satin-wood of Guiana is stated by Aublet to be yielded by his *Ferolia guianensis*, which has both white and reddish coloured wood, both satiny in appearance. The satin-wood of India and Ceylon is yielded by *Chloroxylon Swietenia*.

SASSAFRAS-WOOD, is a species of laurel, (*Sassafras officinalis;*) the root is used in medicine. The small wood is of a light-brown, the large is darker; both are plain, soft, and close. Sassafras-wood measures from 4 to 12 in. diam.; it is sometimes chosen for cabinet-work and turning, on account of its scent.

SAUL, or Sâl, an East Indian timber-tree, the *Shorea robusta*; (*See* 377, Dr. Wallich's Catalogue): this wood is in very general use in India for beams, rafters, and various building purposes; it is close-grained and heavy, of a light brown colour, not so durable but stronger and tougher than teak, and is one of the best timber-trees of India. Captain Baker considers Saul to resist strains, however applied, better than any other Indian timber; he says the Morung Saul is the best. The Sissoo appears to be the next in esteem, and then the teak, in respect to strength. *See* Baker's Papers.

SAUNDERS. *See* RED SAUNDERS.

SERVICE-TREE. This is a kind of thorn, and bears the service-berry, which is eaten: it is very much like English sycamore in every character as regards the wood.

Bergeron describes the service-tree as a very hard, heavy, and useful wood, of a red-brown colour, and well adapted to the construction of all kinds of carpenters' tools. He says they will glue slips of the service-tree upon moulding planes, the bulk of which are of *oak*, on account of its hardness and endurance. He also speaks of a foreign service-tree, (*Cormier des Isles*,) which is harder, but more grey in colour, and more veined: these appear to be totally different woods.

SISSOO, (*Dalbergia Sissoo*,) is one of the most valuable timber-trees of India, and with the Saul, is more extensively employed than any other in north-west India. The ship-builders in Bengal select it for their crooked timbers and knees; it is remarkably strong; its colour is a light greyish brown, with darker coloured veins. "In structure it somewhat resembles the finer species of teak, but it is tougher and more elastic." There are two kinds used respectively in Bengal and Bombay; the latter is much darker in colour. The Indian black rose-wood, (*Dalbergia latifolia*,) is a superior species of Sissoo from the Malabar coast. *See* Baker's Papers.

SNAKE-WOOD, Letter or Speckled wood, is used at Demerara, Surinam, and along the banks of the Orinoko, for the bows of the Indians. The colour of the wood is red hazle, with numerous black spots and marks, which have been tortured into the resemblance of letters, or of the scales of the reptile; when fine it is very beautiful, but it is scarce in England, and chiefly used for the most expensive walking-sticks; the pieces, that are from 2 to 6 in. diam., are said to be the produce of large trees, from three to four times those diameters, the remainder being sap.

Dr. Bancroft says it is "*Bourra courra*, as it is called by the Indians, by the French *bois du lettre*, and by the Dutch *Letter hout*, is the heart of a tree growing 30 feet in height with many branches," &c.

Canjica paise, No. 64, in Mr. Morney's collection of Brazilian woods, is somewhat like snakewood, but less beautiful; it is much less red, and the marks are paler and larger. If not an accidental variety, the wood would be worth seeking.

"The above must not be confounded with the Snake-wood of the West

SNAKE-WOOD—*continued.*

Indies and South America, the *Cecropia,* of which there are three species all furnishing trees of straight and tall growth, and a wood of very light structure, presenting sometimes distinct and hollow cells. The *Balsas,* or floats, used by the Indians of South America for fishing, &c. are very commonly constructed of this wood."—*J. Myers.*

It is thought by some to be the *Tapura guianensis,* of Aublet.

SPECKLED-WOOD. *See* SNAKE-WOOD.

SPANISH CHESNUT. *See* CHESNUT.

SPINDLE-TREE, (*Euonymus europa,*) is a shrubby tree, with a yellow wood, similar to the English boxwood, but straighter and softer: it is turned into bobbins and common articles. Bergeron says the wood is used in France for inferior carpenters' rules, and that its charcoal, prepared in a gun-barrel or any closed vessel, is very suitable to the artist, as its mark may be effaced.

SYCAMORE, the *Acer pseudo-platanus,* is common to Europe; it is also called great maple, and in Scotland and the north of England the plane-tree. Its mean size is 32 ft. high; is a very clean wood, with a figure like the plane-tree, but much smaller; it is softer than beech, but rather disposed to brittleness. The colour of young sycamore is silky white, and of the old brownish white; the wood of middle age is intermediate in colour, and the strongest: some of the pieces are very handsomely mottled. It is used in furniture, pianofortes and harps, and for the superior kinds of Tunbridge turnery; it may be cut into very good screws, and it is used for presses, dairy utensils, &c. *See* MAPLE.

A variety of sycamore, which is called harewood, is richer in figure and sometimes striped, but it is in other respects similar to the above. Some of the foreign kinds are very beautifully rippled or waved, and almost as richly so as satin-wood, such pieces are selected for the backs of the handsomest violins, the sounding boards of which, and of most other instruments, are made of the Swiss deal, which is probably the produce of a Larch.

TEAK-WOOD, is the produce of the *Tectona grandis,* a native of the mountainous parts of the Malabar coast, and of the Rajahmundry Circars, as well as of Java, Ceylon, and the Moulmein and Tenasserim coasts.

It grows quickly, straight, and lofty; the wood is light and porous, and easily worked, but it is nevertheless strong and durable; it is soon seasoned, and being oily, does not injure iron, and shrinks but little in width. Its colour is light brown, and it is esteemed most valuable timber in India for ship-building, house-carpentry, &c.: it has many localities. The Malabar teak grown on the western side of the Ghaut mountains is esteemed the best, and is always preferred for our Government dock-yards. Teak is considered a more brittle wood than the Saul or the Sissoo.

In 25 years the teak attains the size of two feet diameter, and is considered serviceable timber, but it requires 100 years to arrive at maturity.

TEAK-WOOD—*continued.*

There is a variety, says Dr. Roxburgh, which grows on the banks of the Godavery in the Deccan, of which the wood is beautifully veined, closer grained and heavier than the common teak tree, and which is well adapted for furniture.

Some of the old trees have beautiful burrs, resembling the Amboyna, which are much esteemed. I have an excellent specimen of this, through the kindness of Dr. Horsfield, of the India House.

The woods in general do not very perceptibly alter in respect to length; Teak, says Colonel Lloyd, is a remarkable exception. He found the contraction in length, in the beams of a large room he erected in the Mauritius, to be three quarters of an inch in 38 feet.

The teak-wood when fresh has an agreeable odour, something like rosewood, and an oil is obtained from it. He adds, " The finest now produced comes from Moulmein and other parts of Burmah; some of this timber is unusually heavy and close-grained, but in purchasing large quantities care must be taken that the wood has not been tapped for its oil, which is a frequent custom of the natives, and renders the wood less durable.".

" At Moulmein, so much straight timber is taken and the crooked left, that thousands of pieces called 'shin logs,' and admirably adapted for ship-timbers, are left. Teak contains a large quantity of silicious matter, which is very destructive to the tools."

African teak does not belong to the same genus as the Indian teak; by some it is thought to be a *Euphorbiaceous* plant, and by Mr. Don to be a *Vitex.*

TOON-WOOD, has already been mentioned under the head of Cedar, as being similar to the so-called Havannah cedar, the *Cedrela odorata.* The toon-tree is *C. Toona;* its wood is of a reddish-brown colour, rather coarse-grained, but much used all over India for furniture and cabinet-work.

TULIP-WOOD, is the growth of the Brazils. The wood is trimmed and cut like King-wood, but it is in general very unsound in the center, its colour is flesh red with dark red streaks; it is very handsome, but it fades. The wood, which is very wasteful and splintry, is used in turnery, Tunbridge ware manufactures, and brushes; it is often scarce.

The specimen in W. Loddiges's collection from Rio Janeiro, (also called St. Sebastian), bore the Portuguese name of *Sebastaõ Aruda;* that in Mr. Morney's, at the Admiralty, *Sebastiaõ d'Arruda,* and Mr. ———'s *St. Sebastine d'Arooda,* evidently the same; that in my German collection, *Ferolia arbor.—Lignum in modo marmoris variegatum.*

A wood sometimes called French tulip-wood, from its estimation in that country, appears to resemble a variegated cedar: it is much straighter and softer in the grain than the above; the streaks are well contrasted, the light being of an orange red: it appears to be a very excellent furniture and turnery-wood, but has no smell; it contains abundance of gum, and is considered to come from Madras, but which peninsula has no pines.

VINHATICO. The Portuguese name for several yellow and yellow-brown woods. *See* CANARY-WOOD.

VIOLET-WOOD. *See* KING-WOOD.

VINE-WOOD. *See* APRICOT-TREE.

WALNUT. The Royal or Common Walnut, (*Juglans regia,*) is a native of Persia, and the north of China. Walnut was formerly much used in England before the introduction of mahogany. The heart-wood is of a greyish brown, with black-brown pores, and often much veined with darker shades of the same colour; the sap-wood is greyish white. Some of the handsome veneers are now used for furniture, but the principal consumption is for gun-stocks, the prices of which in the rough vary from a few pence to one and two guineas each, according to quality. An inferior kind of walnut is very much used in France for furniture, frames of machines, &c.; it is less brown than the fine sort.

The Black Virginian Walnut, (*Juglans nigra,*) is a native of America, and is found from Pennsylvania to Florida. It is a large tree, has a fine grain, is beautifully veined, and is the most valuable of the American kinds for furniture.

The White Walnut is the Hickory, which *see.*

WILLOW. There are many varieties of the willow (*Salix*). It is perhaps the softest and lightest of our woods. Its colour is tolerably white, inclined to yellowish-grey: it is planed into chips for hat-boxes, baskets, and wove bonnets; it has been attempted to be used in the manufacture of paper. The small branches of willow are used for hoops for tubs, the large wood for cricket-bats. From the facility with which it is turned, it is in demand for boxes for druggists and perfumers, which are otherwise made of small birch-wood.

The wood of the willow is described by Mr. Loudon as soft, smooth, and light; the wood of the larger species, as *Salix alba* and *Russelliana*, is sawn into boards for flooring. The red wood willow, *S. fragilis*, is said to produce timber superior to any other species: it is used for building light and swift-sailing vessels; *S. Russelliana* being closely allied to *S. fragilis* is probably allied to it in properties. The wood of *S. caprea* is heavier than that of any other species. Hats are manufactured in France from strips of the wood *S. alba*.

YACCA WOOD, or Yacher, from Jamaica, is sent in short crooked pieces like roots, from 4 to 12 in. thick. The wood is pale brown, with streaks of hazel brown; it is principally used for cabinet and marquetry work, and turning: some pieces are very handsome.

YELLOW WOOD. There is a fine East India wood thus called: it appears to be larger and straighter than boxwood, but not so close-grained. I should think it would be found to be a valuable wood for the arts: my specimen agrees almost perfectly with *Murraya*, No. 275 of Dr. Wallich's collection.

This is probably a *Nauclea*. The wood of *Nauclea cordifolia*, according to Dr. Roxburgh, is exceedingly beautiful in colour, like boxwood, but much lighter, and at the same time very close-grained. It is used by the inhabitants of Northern India to make combs of.

YEW: the yew-tree is common in Spain, Italy, and England; it is indigenous to Nottinghamshire. The tree is not large, and the wood is of a pale yellow red colour, handsomely striped, and often dotted like Amboyna. It has been long famed for the construction of bows, and is still so employed, although the undivided sway it held in the days of Robin Hood has ceased. The English species, (*Taxus baccata,*) is esteemed a hard, tough, and durable wood: it is a common saying amongst the inhabitants of the New Forest in Hampshire, that a post of yew will outlive a post of iron; it would appear the yew-tree lives to a great age, as some of those in Norbury Park are said to have been recorded in Domesday Book. The yew-tree is used for making chairs, handles, archery-bows, walking-sticks, &c. Some of the older wood is of a darker colour, more resembling pale walnut-tree, and very beautifully marked; the finer pieces are reserved for cabinet-work: it is a clean wood for turning. The Irish yew is preferred for bows.

The burrs of the yew-trees are exceedingly beautiful, and although larger in figure they sometimes almost equal the Kiabooca.

The American yew, *Taxus canadensis*, is supposed to be only a variety of *T. baccata*; the Himalayan species are closely allied to this and to *T. nucifera*.

ZANTE, or Young Fustic, from the Mediterranean, is a species of sumach, (*Rhus Cotinus*). It is small and of a golden yellow, with two thirds sap; it is only used for dyeing, and is quite distinct from the *Morus tinctoria*, or old fustic.

Speaking of this tree, Dr. Bancroft says: " A distinction was improperly created at least 130 years ago, (now 180,) calling that of the *Venice sumach Young* Fustic, (as being manifestly the wood of a small shrub,) and that of *Morus tinctoria*, (which is always imported in the form of large logs or blocks,) *Old* Fustic."—*Bancroft's Phil. of Colours*, v. i. p. 413.

The Zante is also called *Chloroxylon*, its modern Greek name is *Imppore*.

ZEBRA-WOOD is the produce of the Brazils, and Rio Janeiro; it is sent in logs, and planks, as large as twenty-four inches. The colour is orange-brown, and dark brown variously mixed, generally in straight stripes; it is suitable to cabinet-work and turnery, as it is very handsome. A wood from New South Wales bearing some resemblance to the above is sometimes called by the same name, as also others in which the stripes are of a distinct and decided character.

The zebra-wood is considered by upholsterers to be intermediate in general appearance between mahogany and rose-wood, so as to form a pleasing contrast with either of them. The Portuguese name for the zebra-wood appears from Mr. G. Loddiges' collection to be *Burapinima*, and from Mr. ———'s *Goncalo do para*; No. 63, of the last group, *Casco do tartarua*, is like Zebra, but heavier, more handsome, and of a rich hazle brown, with black wavy streaks. The pigeon-woods are usually lighter, and of more yellow-browns.

Zebra-wood is also called Pigeon-wood by Browne; one kind of Pigeon-wood in Jamaica is *Guettarda speciosa*; another kind, called also Zebra-wood, is described by Browne, but he was unable to make out the genus.

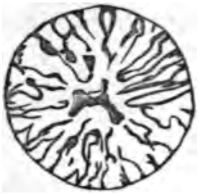
SUPPLEMENT.

MATERIALS DERIVED FROM THE VEGETABLE KINGDOM.

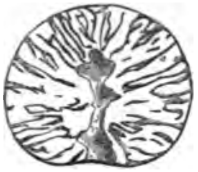
BETLE-NUTS, or Areca-nuts, are the fruit of the *Areca Catechu*, or *Faufel;* they have a thin brown rind, and in size they are intermediate between walnuts and hazel nuts; their general substance is of a faint oily grey colour, thickly marked with curly streaks of dark brown or black. The betle-nuts, although softer, resemble ivory, as regards the act of turning; they are made into necklaces, the tops of walking sticks, and other small objects. The substance of the betle-nut, together with quick-lime, is chewed by the generality of the natives of India.

Fig 24 is the section of the betle-nut, full sized, and at right angles to the stalk. Fig. 25 is the section through the line of the stalk, which shows the central cavity. Externally the marks constitute a tortuous running pattern, as seen in the turned knob, fig. 26.

Figs. 24.



25.



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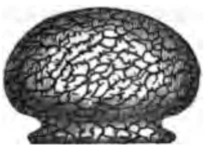


COCOA-NUT SHELL. The general characters of this fruit, the produce of the palm *Cocos nucifera,* are too well known to need particular description: in India its thick fibrous husk is made into the *Coir* rope; the substance of the shell is very brittle, and its structure is somewhat fibrous, but it admits of being turned in an agreeable manner. Those shells which are tolerably circular are used for the bodies of cups and vases, the feet and covers being made of wood or ivory. Common buttons are also made of the cocoa-nut shell, and are considered better than those of horn, as they do not like that material absorb moisture, which causes them to swell and twist.

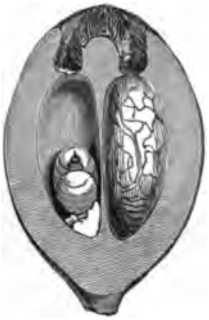
COQUILLA NUTS are produced in the Brazils by *Attalea funifera,* according to Martius, or the *Cocos lapidea* of Gærtner; the latter title is highly descriptive. The coquilla nut is represented in section, half size, in fig. 27: the shell is nearly solid, with the exception of the two separate cavities represented, each containing a hard, flattened, greasy kernel, generally of a disagreeable flavour: the cells occasionally enclose a grub or chrysalis similar to that figured, which consumes the fruit. The passages leading into

COQUILLA NUTS—*continued.*

the chambers are lined with filaments or bristles, and this end of the shell terminates exteriorly in a covering of these bristles, which conceal the passages ; this end is consequently almost useless, but the opposite is entirely solid, and terminates in the pointed attachment for the stalk. Sometimes the shell contains three kernels, less frequently but one only, and I have heard of one coquilla nut that was entirely solid.

The substance of the shell is brittle, hard, close, and of a hazel brown, sometimes marked and dotted, but generally uniform. Under the action of sharp tools it is very agreeable, more so than the cocoa-nut shell ; it may be eccentric turned, cut into excellent screws, and admits of an admirable polish and of being lackered. On the whole it is a very useful material ; it is suitable for a great variety of small ornamental works both turned and filed, and is extensively manufactured into the knobs of umbrellas and parasols, small toys, &c.

Figs. 27.



28.

29.

COROSOS, or IVORY-NUTS, are produced by *Phytelephas macrocarpa*, growing in central America and Columbia, (Humboldt.) They are described as seeds with *osseous albumen;* the tree is a genus allied to the *Pandaneæ,* or Screw Pines, and also to the Palms. The nuts are of irregular shapes, from one to two inches diameter, and when enclosed in their thin husks, they resemble small potatoes covered with light brown earth : the coat of the nut itself is of a darker brown, with a few loose filaments folded upon it. The internal substance of the ivory-nut resembles white wax rather than ivory ; it has, when dried, a faint and somewhat transparent tint, between yellow and blue, but when opened it is often almost grey from the quantity of moisture, in losing which it contracts considerably. Each nut has a hole, which leads into a small, central, angular cavity ; this, joined to the irregularity of the external form, limits the purposes to which they are applied—principally the knobs of walking-sticks, and a few other small works.

Fig. 28 is the section of the ivory-nut at right angles to the stalk, and half size ; and fig. 29 is the section through the stalk itself, which proceeds from *s*.

"THE NEW WOOD," this curious name is applied by Mr. Marshall, Upholsterer of Soho Square, to some very beautiful wood in his possession, apparently of several distinct kinds, the proper names for which are unknown, although he has submitted specimens of them to various institutions in England, Scotland, France, &c.

It is in pieces eight or ten feet long, and about twelve inches diameter, which are externally of a dark purple brown, entirely divested of bark and sap. The wood is very fine in the grain, hard and heavy, and although oily, free from scent; splinters of it blister the workmen's hands very quickly. These woods, (of which Mr. Marshall has favoured me with specimens,) display all the characters and colours of the most handsome kinds with which we are acquainted, without being strictly like any of them; they well deserve the inspection of the curious, or those who may think their description over-rated.

MEMOIR ON THE PRESERVATION OF WOODS. A paper bearing this title was lately read before the French Academy of Sciences, by its author, Dr. Boucherie, and I propose, as an appropriate sequel to the foregoing pages upon the woods, to attempt to convey a general notion of the numerous experiments referred to.

He contrasts the increasing consumption and the rapid decay of timber with its slow rate of production, which make it necessary to economize its employment. He adverts to the many projects for its preservation, enumerated by our countryman Mr. John Knowles, (*see* Note, p. 22,) and the methods subsequently proposed, to many of which he objects from their uselessness; to others from the slow and superficial manner in which timbers part with their contained fluids, or absorb new ones by simple immersion, (circumstances long since proved by Duhamel;) and to all from their *expense*, the ultimate test of general application.

Dr. Boucherie argues, that all the changes in woods are attributable to the soluble parts they contain, which either give rise to fermentation or decay, or serve as food for the worms that so rapidly penetrate even the hardest woods. As the results of analysis he says, that sound timbers contain from three to seven per cent. of soluble matters, and the decayed and worm-eaten rarely two, commonly less than one, per cent.; he therefore concludes that "since the soluble matters of the wood were the causes of the changes it undergoes, it is necessary to its preservation, either to abstract the soluble parts in any way, or to render them insoluble by introducing substances which should render them infermentable or inalimentary;" which he considers may be done by many of the metallic salts and earthy chlorides.

Dr. Boucherie shows, by parallel experiments upon "vegetable matters very susceptible of decomposition, as flour, the pulps of carrot and beet-root, the melon, &c., (which only differ from wood, of which they possess the origin and constitution, by the greater proportion of soluble matter which they contain,)" that in the natural states they rapidly alter, but are pre-

MEMOIR ON THE PRESERVATION OF WOODS—*continued.*

served by the pyrolignite of iron, (pyrolignite *brut* de fer,) a cheaper material than the corrosive sublimate commonly used, and one very desirable in several respects. He presumed that by immersing the end of a tree *immediately after it was felled* into a liquid, the vital energies not having ceased, the tree would then absorb such fluid through all its pores, by a process which he calls aspiration ; and in this fortunate surmise he was entirely successful. This led step by step to numerous practical results, which their inventor enumerates as follows, and describes in separate chapters.

1st. " For protecting the woods from the dry or wet rot."

2nd. " For augmenting their hardness."

3rd. " For preserving and developing their flexibility and their elasticity."

4th. " For rendering impossible the changes of form (*jeu*) they undergo, and the splits (*disjonctions*) which take place when they are brought into use, or are submitted to atmospheric changes."

5th. " For greatly reducing their inflammability and combustibility."

6th. " For giving them various and lasting colours and odours."

I shall endeavour to convey a general notion of the methods in the same order.

1. Durability. He took a poplar-tree, measuring 28 *mètres* in height and 40 *centimètres* diameter, simply divided from its root with its branches and leaves undisturbed, and immersed it erect to the depth of 20 *centimètres* in a vessel containing pyrolignite of iron ; in six days it was entirely impregnated even to the leaves, and had absorbed the large quantity of three *hectolitres* (p. 132). This method required powerful lifting apparatus, and a support for the tree to lean against, and was therefore objectionable.

He repeatedly operated upon trees lying on the ground, by attaching to their bases waterproof bags containing the liquid : the experiments were varied in many ways ; sometimes portions of the branches were lopped off, but the crown or tuft was always left upon the principal stem ; at other times the aspiration was effected by boring detached holes near the earth supplied with different fluids, which gave rise to all kinds of diversities ; and other trees were pierced entirely through, and a horizontal cut extending to within an inch or so of each side was made with a thick saw, leaving only sufficient wood for the support of the trees.

For fear of losing the trees upon which he had the opportunity of experimenting, the process was not deferred beyond 24, 36, or 48 hours after they were felled, as the vigour of the absorption was found to abate rapidly after the first day, and that at about the tenth day it was scarcely perceptible : it was also found the aspiration entirely failed in *dead* wood, whether occurring at the heart of old trees, or at parts of others from any accidental interruption of the flow of the sap during the growth ; and also that resinous trees absorbed the fluids less rapidly than others.

Observations were also made of the quantities of the liquids taken up ;

MEMOIR ON THE PRESERVATION OF WOODS—*continued.*

these, when of a neutral kind, as the chloride of soda, often equalled in bulk that of the wood itself, without causing any addition to its weight; the acid and alkaline fluids were less abundantly absorbed, apparently from contracting the vessels by their astringent action. It is stated that the pyrolignite of iron effected the preservation of the substance when equal to less than a fiftieth part of the weight of the green wood. These points are all separately treated in the original paper.

2. The hardness of the wood was considered by various workmen to be more than doubled by the action of the pyrolignite.

3. The flexibility, (due to a certain presence of moisture,) was increased in a remarkable manner by the chloride of lime and other deliquescent salts, the degree of elasticity depending upon their greater or less concentration. As a cheap substitute for the above, the stagnant water of salt marshes was adopted, with a fifth of the pyrolignite, for the greater certainty of preservation. Pieces of prepared deal, 3 *millimètres* thick and 60 *centimètres* long, were capable of being twisted and bent in all directions, as into screws, also into three circular coils; the wood immediately regained its figure when released; this condition lasted eighteen months, that is, until the time his paper was read.

4. The warping and splitting, principally due to the continual effect of the atmosphere in abstracting and restoring the moisture, was stayed by impregnating the wood with a weak infusion of the chloride, so as always to retain it to a certain degree moist; one-fifth of pyrolignite was also added in this case. The seasoning of the wood was also considered to be expedited by the process, and which was not found to interfere with the ordinary use of oil-paint, &c. Large boards of the prepared wood, some of which were painted on one or both sides, and similar boards of unprepared wood were compared; at the end of twelve months, the former were perfect as to form, the latter were warped and twisted as usual.

5. The inflammability and combustibility of the woods were also prevented by the earthy chlorides, which fuse on their surfaces by the application of heat, and render them difficult of ignition. Two similar cabins were built of prepared and of ordinary wood respectively, and similar fires were lighted in each; the latter was entirely burned, the other was barely blackened.

6. In respect to colours infused by the aspiratory process, the vegetable colours were found to answer less perfectly than the mineral, and the latter succeeded best when the colour was introduced at two processes, so that the chemical change, (that of ordinary dyeing,) occurred in the pores of the wood itself. Odorous matters, required to be infused in weak alcoholic solutions, or essential oils, they were considered to be equally durable with those supplied by the hand of nature; and resins similarly introduced were found to increase amazingly the inflammability of the woods, and to render them impervious to water.

MEMOIR ON THE PRESERVATION OF WOODS—*continued.*

In a word, the method promises the means of working almost any desired change in the constitution and properties of woods, when the fluids are presented to them before the vitality of the tree has ceased. It is true we have as yet only two years' trial of these experiments, but they have been scientifically deduced, and their inventor is still engaged in prosecuting them. It is to be hoped, and also expected, that these interesting and flattering promises of success will be realized, and even extended, when tried by that most severe of all tests, time *.

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* Since I collected the above particulars from the number for June, 1840, of *Les Annales de Chimie et de Physique*, pp. 113 to 157, I have been favoured by J. E. Puddock, Esq., with a printed copy of the English translation of the original paper, preceded by the report of Messrs. De Mirbel, Arago, Poncelet, Audouin, Gambey, Boussingault, and Dumas, on the part of *l'Académie des Sciences*, confirming the value of the invention. In France, Dr. Boucherie has relinquished his *brevèt*, and thrown the process open to the public in consideration of a national reward; and immense preparations are being there made, by the Minister of Marine, for the employment of the preservative process for the French navy, &c. In England Dr. Boucherie and Company have obtained two patents, and Mr. Puddock, their agent, has specimens of pine, plane-tree, &c., variously prepared and coloured, with the pyrolignite of iron, the prussiate of iron, the prussiate of copper, and various other metallic salts, &c.

See APPENDIX, Note B. in respect to Mr. Bethell's claim to this invention.

APPENDIX.

Note A.—To follow the end of Page 46.

The Patent Wood Carving. This is not accomplished in the usual manner, by cutting away the wood with chisels, but it is burned away, or rather converted into charcoal. The oak, mahogany, rose-wood, horse-chesnut, or other wood, is steeped in water for about two hours; and the cast-iron die or mould containing the device, is heated to redness or sometimes to a white heat, and applied against the wood; either by a handle as a branding-iron, by a lever-press, or by a screw-press, according to circumstances; the moulds are made by the iron-founder from plaster casts of the original models or carvings.

Had not the wood been saturated with water it would be ignited, but until the moisture is evaporated it is only charred; it gives off volumes of smoke, but no flame. After a short time the iron is returned to the furnace to be re-heated, the blackened wood is well rubbed with a hard brush to remove the charcoal powder, which, being a bad conductor of heat, saves the wood from material discoloration; and before the re-application of the heated iron the wood is again soaked in water, but for a shorter time, as it now absorbs moisture with more facility.

The rotation of burning, brushing, and wetting is repeated ten or twenty times or upwards, until in fact the wood fills every cavity in the mould, the process being materially influenced by the character and condition of the wood itself, and the degrees in which the heat and moisture are applied. The water so far checks the destruction of the wood, or even its change of any kind, that the burned surface simply cleaned by brushing, is often employed, as it may be left either of a very pale or deep brown, according to the tone of colour required, so as to match old carvings of any age; or a very little scraping removes the discoloured surface. Perforated carvings are burned upon thick blocks of wood, and cut off with the circular saw.

The patent mode is considerably cheaper than ordinary carving, and the more so the greater the complexity and delicacy of the design. The date of the Patent granted to Messrs. A. S. Braithwaite and Co. for this novel process is Nov. 1840.

Note B.—To follow the Foot Note on Page 116.

Subsequently to the extract from "*Dr. Boucherie's Memoir on the Preservation of Woods*" having been printed upon page 113—116 of this work, the subject came under the notice of the Institution of Civil Engineers; and in justice to the prior claim of Mr. Bethell, I have quoted the following paragraphs from the Minutes of Proceedings of that Institution for 1842, page 88—9.

"Mr. Bethell remarked that the process described in Dr. Boucherie's pamphlet was identical with that patented by him July 11th, 1838, two years before Dr. Boucherie's was mentioned in Paris, which was in June 1840. The specification filed by Mr. Bethell stated "that trees just cut down may be rapidly impregnated with the solution of the first class, hereafter mentioned (among which is included the pyrolignite of iron) by merely placing the butt ends in tanks containing the solution, which will circulate with the sap throughout the whole tree; or it may be done by means of bags made of water-proof cloth affixed to the butt ends of the trees and then filled with the liquid."—*See* Specification in Repertory of Patents, March 1842.

"Mr. Bethell found that some solutions were taken up more rapidly by the sap and circulated with it more freely than others, and the pyrolignite of iron seemed to answer best; he had not hitherto introduced the process in England because it was much more expensive than the oil of tar, the pyrolignite costing from 6*d.* to 9*d.* per gallon, and the oil being delivered at 3*d.* per gallon."

"In answer to a question from Mr. Pellatt, Mr. Bethell stated that his experiments on the use of silicate of potash or soluble glass for rendering wood uninflammable were not yet concluded: he had proved its efficacy in this point—that as soon as the prepared timber was heated, the glass melted and formed a filmy covering over the surface, which protected it from the oxygen of the air and prevented its catching fire. The silicate also hardened the wood and rendered it more durable. This process was included in his patent of July 11th, 1838."

By the same Author.

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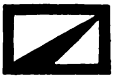

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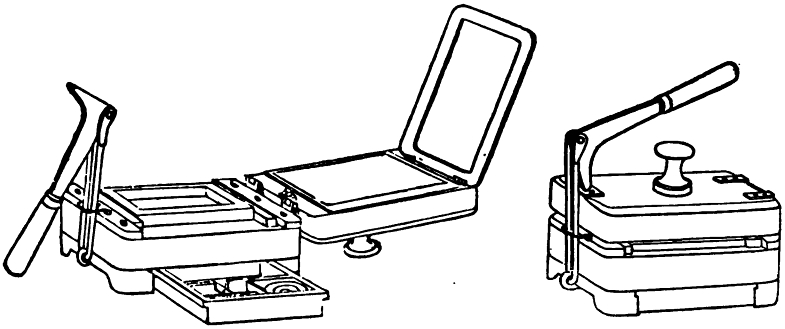

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